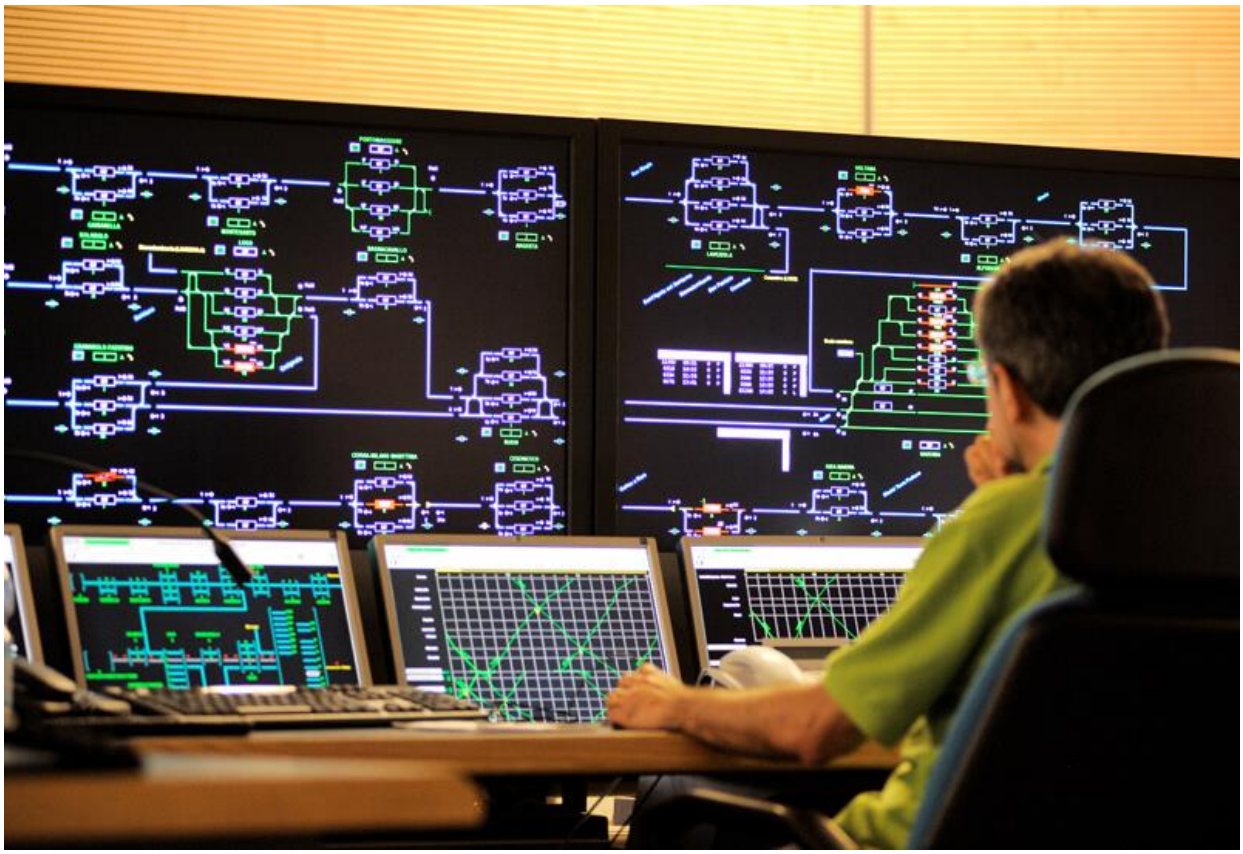
# National Competency Standards Level 5 for "Instrumentation Technology"



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

## ACKNOWLEDGEMENTS

National Vocational and Technical Training Commission (NAVTTC) extends its gratitude and appreciation to many representatives of business, industry, academia, government agencies, Provincial TEVTAs, Sector Skill Councils and trade associations who speared their time and expertise to the development and validation of these National Vocational Qualifications (Competency Standards, Curricula, Assessments Packs and related material). This work would not have been possible without the financial and technical support of the TVET Sector Support Programme co-funded by European Union, Germans and Norwegian and German Governments implemented by GIZ Pakistan. NAVTTC is especially indebted to *Dr. Muqeem ul Islam,* who lead the project from the front. The core team was comprised on:

- *Dr. Muqeem ul Islam,* Director General (Skills Standards and Curricula) NAVTTC
- *Mr. Muhammad Naeem Akhtar*, Senior Technical Advisor TSSP-GIZ,
- *Mr. Muhammad Yasir*, Deputy Director (SS&C Wing) NAVTTC
- *Mr. Muhammad Ishaq,* Deputy Director (SS&C Wing) NAVTTC
- *Mr. Muhammad Fayaz Soomro,* Deputy Director (SS&C Wing) NAVTTC

NAVTTC team under the leadership of Dr. Muqeem ul Islam initiated development of CBT & A based qualifications of diploma level-5 as a reform project of TVET sector in November 2018 and completed 27 NVQF diplomas of Level-5 in September, 2019. It seems worth highlighting that during this endeavor apart from developing competency standards/curricula in conventional trades new dimensions containing high-tech trades in TVET sector in the context of generation IR 4.0 trades have also been developed which inter alia includes Robotics, Mechatronics, artificial intelligence, industrial automation, instrumentation and process control. Moreover, trades like entrepreneurship, green/environmental skills and variety of soft/digital skill have also been developed to equipped the Pakistani youth with skills set as per requirement of the global trends. These skills have been made integral part of all the 27 diplomas.

Nobody has been more important in the pursuit of this project than Dr. Nasir Khan, Executive Director, NAVTTC, whose patronage and support remain there throughout the development process and lastly to thanks specially to Syed Javed Hassan Chairman NAVTTC and Raja Saad Khan, Deputy Team Lead TSSP-GIZ who made it happened in this challenging time.

## CONTENTS

## 1. INTRODUCTION

Instrumentation Technology is specifically designed for students of Electronics/Electrical and touches upon a variety of fundamental topics. This course will cover a major portion of Instrumentation Technology. This training program will also build upon these general concepts to cover object-oriented Instrumentation terminology.

This specialization covers topics ranging from basic Electrical & Electronics Measuring Instrumentation, basic engineering drawing & CAD, Instrumentation drawing, Instrumentation servicing & calibration, Industrial Instrumentation . You will learn fundamental concepts of Microprocessor applications. We also get practical exposure of Boiler Installation & operation. By the end of this course, trainee will understand the basics of Instrumentation Technology & able to work in an Industry..

The National Skills Strategy (NSS) aims at achieving a paradigm shift from time-bound and supply led to competency-based and demand driven training in Pakistan. Competency-based training approach focuses on the demonstration of actual skills required in the workplace/industry. To achieve this strategy, NAVTTC in collaboration with GIZ is involved in the development process of CBT program to ensure competent skilled labor in demand driven vocational trades.

National Vocational Qualification Framework (NVQF) as designed in consultation with the stakeholders including academia, researchers, industry, chambers and TEVTAs. Its aim is to identify knowledge & skills required for a qualification, determine equivalence, provide guidelines for Recognition of Prior Learning (RPL) and assure quality of training. NVQF designed for the Vertical and horizontal progression for learners, recognition of qualification, meeting with the national and international standards, facilitate conversion of informal training to formal training through RPL, improvement in quality of training and increased options for learners for selecting training programs in different trades. Competency Standards are performance specification that identify the *knowledge* and *competencies* an individual need to succeed in the workplace.

## 2. PURPOSE OF THE QUALIFICATION

The purpose of this qualification is to give the student a thorough understanding and skills of the Instrumentation Technology in three years training program. The Instrumentation technology industry needs skilled labour for meeting the national and international standards. It is therefore important to stress the need for a multidisciplinary approach to meet the challenges within the sector. Upon successful completion of this course the trainee should be able to know:

- Basic principles of Electricity & Electronics
- Installation of process variable measuring Instruments
- Instrumentation servicing & Calibration.
- Interface sensors & Transducer
- Improve the Digital & soft skills of the trainees
  Install & operate Boiler Instrumentation system
- Improve the quality and effectiveness of training and assessment for information technology industry skilled labour

- Enhance Entrepreneurial skills of the trainee & will be able to start their own Business.

## 3. DATE OF VALIDATION

These national qualifications have been validated by the Qualification Development Committee (QVC) on 27-29 May, 2019 in Lahore and will remain currency until **28 May 2029.**

## 4. DATE OF REVIEW

These national qualifications shall be reviewed in **May, 2022**

## 5. CODE OF QUALIFICATION

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 for "Instrumentation Technology" level 5 (Diploma)** | |
|---|---|
| **Code** | **Description** |
| **0714E&A(5)** | National Vocational Certificate level 5, in "Instrumentation Technology" |
| **0714E&A(4)** | National Vocational Certificate level 4, in "Instrumentation Technology" |
| **0714E&A(3)** | National Vocational Certificate level 3, in "Instrumentation Technology" |
| **0714E&A(2)** | National Vocational Certificate level 2, in "Instrumentation Technology" |
| **0714E&A(1)** | National Vocational Certificate level 1, in "Instrumentation Technology" |

## 6. QUALIFICATION DEVELOPMENT COMMITTEE

The following members participated in the qualifications development workshop 2019 in Karachi

| S. No. | Name & Designation | Organization |
|---|---|---|
| **1.** | Mr. Danish Attiq, Project Manager | Skill Tech International, Karachi |
| **2.** | Engr Bilal Mehmood, Senior Instructor | Skill Tech International, Karachi |
| **3.** | Engr Auragzeb Ansari, Assistant Professor | Usman Institute of Technology, Karachi |
| **4.** | Engr Hassan Ali Rizvi, Assistant Manager | Lucky Cement Limited Karachi |
| **5.** | Mr. Umair, Maintenance Engineer | SAPT, Karachi |
| **6.** | Mr. Babar Sayeed, Chief Instructor | PSTC Karachi |
| **7.** | Mr. Adeel Ahmed, Manager Production | Habib Oil Mills, Karachi |
| **8.** | Mr. Sohail Akhtar, SSO | PCSIR, Karachi |
| **9.** | Mr. Syed Farhan Hamid, Senior Instructor | PSTC Karachi |
| **10.** | Mr. Muhammad Yasir, Assistant Director NAVTTC | NAVTTC, Islamabad |
| **11.** | Mr. Ayub Nasir, DACUM facilitator | FWO |
| **12.** | Dr. Abid Karim, Senior Scientific Officer | PCSIR, Karachi |
| **13.** | Dr. Zeeshan , HOD, electronics | Dawood Engineering University Karachi |

## 7. QUALIFICATION VALIDATION COMMITTEE

The following members participated in the qualification validation workshop from 27-29 May 2019, in Lahore:

| S.No. | Name & Designation | Organization |
|---|---|---|
| **1.** | Hafiz ur Rehman<br>Associate Professor | KP- TEVTA |
| **2.** | Aijaz Ahmed Zia<br>D&A Engineer | INTECH Process Automation |
| **3.** | Abdur Rehman<br>Research Assistant | PBTE Lahore |
| **4.** | Syed Farhan Hamid Ali<br>Sr.Instructor/Assistant<br>DACUM Facilitator | Pak Swiss Training Centre Karachi |
| **5.** | Pir Bakhush khan<br>HoD/SSO | Centre for Development of Laboratory Equipments Lahore, Lahore Laboratory complex |
| **6.** | Engr. Liaquat Ali Jamroo<br>Director Academics | STEVTA |
| **7.** | Muhammad Arshad<br>Principal | PSTC Lahore |
| **8.** | Muhammad Yasir<br>Assitant Director | NAVTTC HQ |

## 8. ENTRY REQUIREMENTS

Entry requirements of this qualification are Matric Science or level 4 or equivalent

## 9. REGULATIONS FOR THE QUALIFICATION AND SCHEDULE OF UNITS

Not applicable

## 10. PACKAGING OF QUALIFICATION

The national vocational qualifications are packaged as per following:

| Competency Standards | Occupation | NVQF Level | Category | Estimated Contact Hours | | | Cr Hr |
|---|---|---|---|---|---|---|---|
| | | | | Th | Pr | Total | |
| **Level 2** | | | | | | | |
| Maintain Occupational Health and Safety | ***Safety supervisor*** | Level 2 | Functional | 10 | 30 | 40 | 4 |
| Adopt Safety Regulations, Labour Protection Laws, Environmental Protection Laws at Workplace | | Level 2 | Functional | 10 | 30 | 40 | 4 |
| Develop Professionalism | | Level 2 | Generic | 15 | 30 | 45 | 4.5 |
| Verify the DC Fundamentals | ***Jr. Technician*** | Level 2 | Technical | 20 | 60 | 80 | 8 |
| Apply the AC Fundamentals | | Level 2 | Technical | 20 | 60 | 80 | 8 |
| Install Relays & Switches in domestic & industrial applications | | Level 2 | Technical | 15 | 45 | 60 | 6 |
| Install different type of transformers | | Level 2 | Technical | 15 | 45 | 60 | 6 |
| Operate the Measuring Instruments | | Level 2 | Technical | 15 | 45 | 60 | 6 |
| Connect Tubing & Fittings | | Level 2 | Technical | 10 | 30 | 40 | 4 |
| Perform basic machining operations | | Level 2 | Technical | 20 | 60 | 80 | 8 |
| Apply basic computer skills to create a variety of documents | ***Computer Application*** | Level 2 | Technical | 15 | 45 | 60 | 6 |
| Maintain Tools & Equipment. | **Basic Electrical Wiring (Single Phase)** | Level 2 | Technical | 9 | 21 | 30 | 3 |
| Make Cable/Wire Joints | | Level 2 | Technical | 9 | 21 | 30 | 3 |
| Prepare and Install Distribution Boards | | Level 2 | Technical | 9 | 21 | 30 | 3 |
| Carryout Basic Electrical Installation | | Level 2 | Technical | 9 | 21 | 30 | 3 |
| Install Simple Electrical Wiring | | Level 2 | Technical | 9 | 21 | 30 | 3 |
| Perform Testing of Electrical Wiring | | Level 2 | Technical | 9 | 21 | 30 | 3 |
| Repair/ Maintenance of Electrical Installations | | Level 2 | Technical | 9 | 21 | 30 | 3 |
| Carryout Electrical planning and estimation | | Level 2 | Technical | 9 | 21 | 30 | 3 |
| **Total** | | | | **228** | **627** | **855** | 85.5 |

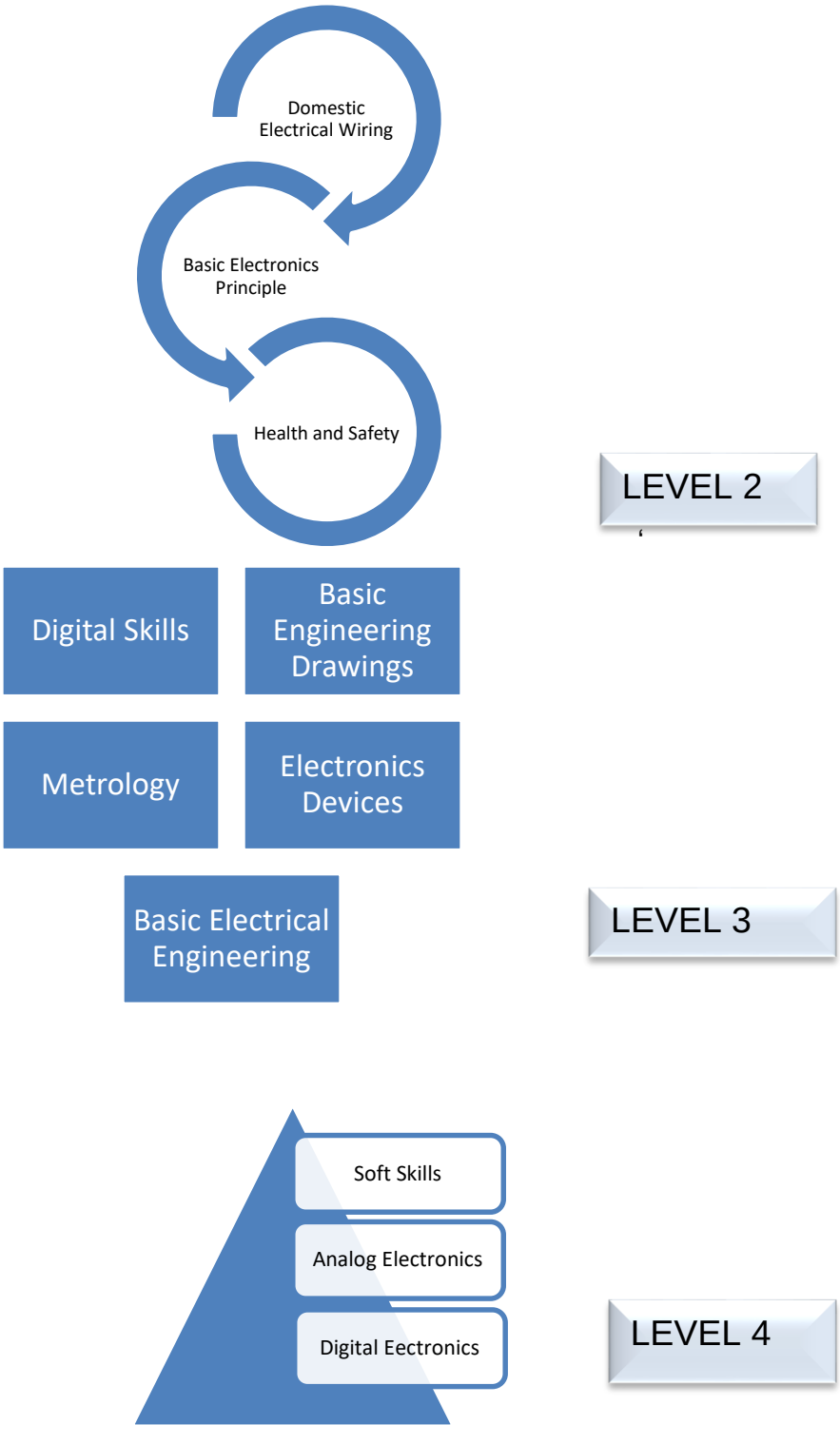
| Level 3 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Install Computer Operating Systems And Hardware | **Digital Skills** | Level 3 | Generic | 6 | 24 | 30 | 3 |
| Operate Word-Processing Applications | | Level 3 | Generic | 6 | 24 | 30 | 3 |
| Operate Spreadsheet Applications | | Level 3 | Generic | 6 | 24 | 30 | 3 |
| Operate Presentation Packages | | Level 3 | Generic | 6 | 24 | 30 | 3 |
| Perform Writing And Editing Tasks | | Level 3 | Generic | 6 | 24 | 30 | 3 |
| Perform Computer Operations | | Level 3 | Generic | 6 | 24 | 30 | 3 |
| Use Computer Applications | | Level 3 | Generic | 6 | 15 | 21 | 2.1 |
| Create User Documentation | | Level 3 | Generic | 6 | 15 | 21 | 2.1 |
| Create Technical Documentation | | Level 3 | Generic | 6 | 24 | 30 | 3 |
| Create Basic Databases | | Level 3 | Generic | 6 | 24 | 30 | 3 |
| Operate Digital Media Technology | | Level 3 | Generic | 6 | 24 | 30 | 3 |
| Use Social Media Tools For Collaboration And Engagement | | Level 3 | Generic | 6 | 24 | 30 | 3 |
| E-Commerce | | Level 3 | Generic | 6 | 24 | 30 | 3 |
| Use Digital Devices | | Level 3 | Generic | 6 | 24 | 30 | 3 |
| Apply basic CAD, Solid works software for designing and drawing | ***CAD Draftman*** | Level 3 | Technical | 20 | 60 | 80 | 8 |
| Install Temperature & Pressure measuring instruments/devices | ***Instrument Technician*** | Level 3 | Technical | 22 | 66 | 88 | 8.8 |
| Install level measuring instruments/devices | | Level 3 | Technical | 20 | 60 | 80 | 8 |
| Install the flow measuring instruments/devices | | Level 3 | Technical | 20 | 60 | 80 | 8 |
| Take measurements with graduated tools | **Metrology** | Level 3 | Technical | 6 | 12 | 18 | 1.8 |
| Take measurements with combination set | | Level 3 | Technical | 6 | 12 | 18 | 1.8 |
| Take measurements through various gauges | | Level 3 | Technical | 6 | 12 | 18 | 1.8 |
| Perform measurements through Micrometer | | Level 3 | Technical | 6 | 12 | 18 | 1.8 |
| Measure dimensions with Vernier tools | | Level 3 | Technical | 6 | 12 | 18 | 1.8 |
| Perform different measurements | | Level 3 | Technical | 6 | 12 | 18 | 1.8 |
| Operate Measuring Instruments. | **Basic Electrical** | Level | Technical | 6 | 18 | 24 | 2.4 |

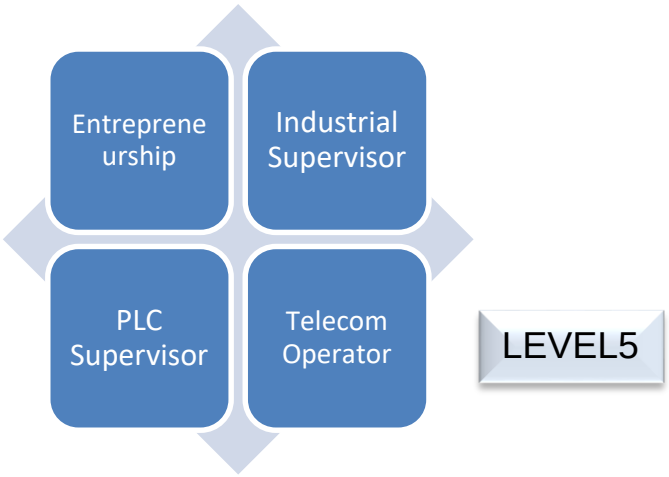
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Engineering** | 3 | | | | | |
| Verify Ohm's Law & Kirchhoff's Law by Implementing Series/Parallel Circuits. | | Level 3 | Technical | 6 | 18 | 24 | 2.4 |
| Measure Electrical Power, Energy, Power Factor & Determine Phase Sequence | | Level 3 | Technical | 6 | 18 | 24 | 2.4 |
| Implement Electromagnet to See Various Effects & Verify Faradays Laws. | | Level 3 | Technical | 6 | 18 | 24 | 2.4 |
| Verify Law of Combination of Capacitor and Determine Break down voltage of Capacitor. | | Level 3 | Technical | 6 | 18 | 24 | 2.4 |
| Identify Basic Electronics Components | **Basic Electronics (Analog)** | Level 3 | Technical | 9 | 21 | 30 | 3 |
| Design a Rectifier using Diode | | Level 3 | Technical | 9 | 21 | 30 | 3 |
| Carry out Diode Application | | Level 3 | Technical | 9 | 21 | 30 | 3 |
| Implement Bipolar Junction Transistor (BJT) in Different Applications | | Level 4 | Technical | 9 | 21 | 30 | 3 |
| Implement Field Effect Transistor (FET) in Different Applications | | Level 4 | Technical | 9 | 21 | 30 | 3 |
| Implement Thyristor Family in Various Application | | Level 4 | Technical | 9 | 21 | 30 | 3 |
| Applications of Operation Amplifier | | Level 4 | Technical | 9 | 21 | 30 | 3 |
| | | | | **295** | **873** | **1168** | **116.8** |
| **Level 4** | | | | | | | |
| Develop Workplace Policy and Procedures for Sustainability | ***Soft skills/ Human Resource*** | Level 4 | Generic | 6 | 24 | 30 | 3 |
| Maintain Professionalism in the Workplace | | Level 4 | Generic | 6 | 24 | 30 | 3 |
| Manage Personal Work Priorities and Professional Development | | Level 4 | Generic | 6 | 24 | 30 | 3 |
| Manage Workforce Planning | | Level 4 | Generic | 6 | 24 | 30 | 3 |
| Undertake Project Work | | Level 4 | Generic | 6 | 24 | 30 | 3 |
| Prepare and Implement Negotiation | | Level 4 | Generic | 6 | 24 | 30 | 3 |
| Manage Meetings | | Level 4 | Generic | 6 | 24 | 30 | 3 |
| Organize Schedules | | Level 4 | Generic | 6 | 24 | 30 | 3 |
| Identify and Communicate Trends in Career Development | | Level 4 | Generic | 6 | 24 | 30 | 3 |
| Apply Specialist Interpersonal and Counseling Interview Skills | | Level 4 | Generic | 6 | 24 | 30 | 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Apply fundamental laws of DC in electrical circuits | ***Foreman*** | Level 4 | Generic | 30 | 90 | 120 | 12 |
| Apply fundamental laws of AC in electrical circuits | | Level 4 | Generic | 30 | 90 | 120 | 12 |
| Use Engineering drawing techniques to produce Instrumentation Drawings | | Level 4 | Generic | 30 | 90 | 120 | 12 |
| Interface the Sensor & Transducers | | Level 4 | Generic | 30 | 90 | 120 | 12 |
| Characterize Diodes Application | ***Electronics Technician*** | Level 3 | Technical | 20 | 60 | 80 | 8 |
| Characterize various FET amplifiers | | Level 3 | Technical | 20 | 60 | 80 | 8 |
| Characterize various BJT amplifiers | | Level 3 | Technical | 20 | 60 | 80 | 8 |
| Characterize various Oscillators | | Level 3 | Technical | 20 | 60 | 80 | 8 |
| Design an Operational Amplifier | | Level 3 | Technical | 20 | 60 | 80 | 8 |
| **Total** | | | | **280** | **900** | **1180** | 118 |
| **Level 5** | | | | | | | |
| Measure the Temperature & humidity | ***Measurements Technician*** | Level 5 | Technical | 22 | 48 | 70 | 7 |
| Measure the Density and Power of Hydrogen Ion (pH) | | Level 5 | Technical | 22 | 48 | 70 | 7 |
| Measure the concentration of environmental gases | | Level 5 | Technical | 22 | 48 | 70 | 7 |
| Calibrate the Measuring instruments (Metrological Instruments) | | Level 5 | Technical | 22 | 48 | 70 | 7 |
| Analyze the gas chromatography | ***Instrumentation supervisor*** | Level 5 | Technical | 22 | 48 | 70 | 7 |
| Perform the spectroscopic characterization | | Level 5 | Technical | 22 | 48 | 70 | 7 |
| Design & Implement a Process Control | | Level 5 | Technical | 9 | 21 | 30 | 3 |
| Install Transducer & Transmitter in Industrial Application | | Level 5 | Technical | 9 | 21 | 30 | 3 |
| Install the process Regulators | | Level 5 | Technical | 9 | 21 | 30 | 3 |
| Install the Variable Frequency Drive ( VFD ) | | Level 5 | Technical | 9 | 21 | 30 | 3 |
| Install Pneumatic & Hydraulic systems in industry | | Level 5 | Technical | 9 | 21 | 30 | 3 |
| Classify the Digital logic Gates | | Level 5 | Technical | 28 | 52 | 80 | 8 |
| Design Microprocessor applications | | Level 5 | Technical | 28 | 52 | 80 | 8 |

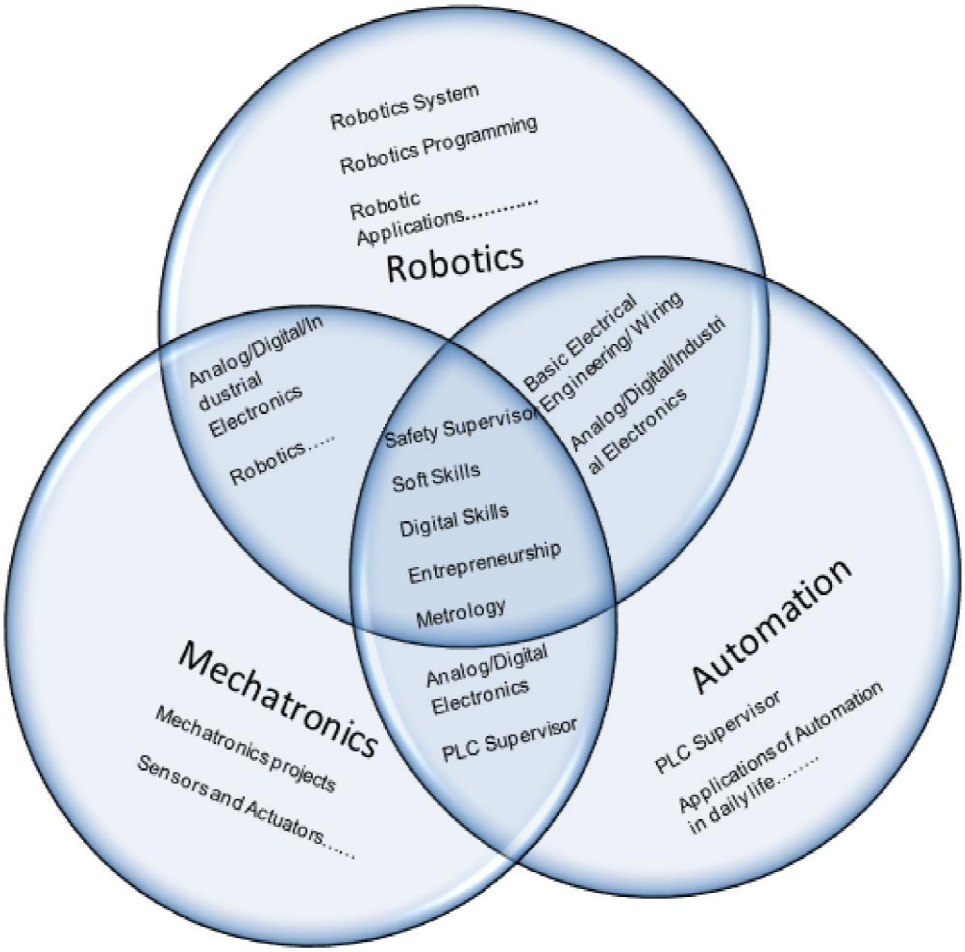
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Design Microcontroller applications | | Level 5 | Technical | 28 | 52 | 80 | 8 |
| Construct an Advance Automation and Control system | | Level 5 | Technical | 28 | 48 | 76 | 7.6 |
| Install the advance control system | ***Boiler Operator*** | Level 5 | Technical | 22 | 48 | 70 | 7 |
| Install the Boiler Control System | | Level 5 | Technical | 9 | 27 | 36 | 3.6 |
| Operate a Boiler Control System | | Level 5 | Technical | 9 | 27 | 36 | 3.6 |
| Investigate Microbusiness Opportunities | ***Entrepreneur*** | Level 5 | Generic | 6 | 18 | 24 | 2.4 |
| Develop A Micro Business Proposal | | Level 5 | Generic | 9 | 15 | 24 | 2.4 |
| Develop A marketing Plan | | Level 5 | Generic | 9 | 15 | 24 | 2.4 |
| Develop And Review A Business Plan | | Level 5 | Generic | 9 | 15 | 24 | 2.4 |
| Organize Finances For The Micro Business | | Level 5 | Generic | 6 | 15 | 21 | 2.1 |
| Manage Human Resources | | Level 5 | Generic | 6 | 15 | 21 | 2.1 |
| Market Products And Services | | Level 5 | Generic | 6 | 24 | 30 | 3 |
| Monitor And Review Business Performance | | Level 5 | Generic | 6 | 24 | 30 | 3 |
| Negotiate For Resolving Business Issues | | Level 5 | Generic | 9 | 21 | 30 | 3 |
| Manage Personal Finances | | Level 5 | Generic | 9 | 15 | 24 | 2.4 |
| Coordinate A Work Team | | Level 5 | Generic | 6 | 24 | 30 | 3 |
| Lead Small Teams | | Level 5 | Generic | 6 | 24 | 30 | 3 |
| **Level 5 Total** | | | | **416** | **924** | **1340** | 134 |

## 11. COMMON COURSES WITH RESPECTIVE LEVELS




Entreprene urship
Industrial Supervisor
PLC Supervisor
Telecom Operator
LEVEL5

## 12. MAPPING OF THE QUALIFICATION



***Health and Safety***

## 0714E&A1. Maintain Occupational Health and Safety

**Overview**:

After this Competency Standard, the Trainee will be able to develop skill and competence required to maintain Occupational Health and Safety and take remedial measures to deal with the emergencies in a professional manner, thus minimizing the losses and providing a safe and healthy working environment.

| Competency Units | Performance Criteria |
|---|---|
| **CU1. Ensure personal protective equipment (PPE)** | P1. Arrange personal protective equipment as per requirements<br>P2. Wear correct personal protective equipment<br>P3. Store PPE at appropriate place after use. |
| **CU2. Maintain First-aid Box** | P1. Ensure availability of first aid box<br>P2. Check first aid box for requisite emergency<br>P3. Check expiry of medicines<br>P4. Perform first aid treatment against electric shocks<br>P5. Perform first aid treatment/bandages against minor injuries. |
| **CU3. Maintain Fire Extinguisher** | P1. Check expiry of fire extinguisher<br>P2. Operate fire extinguisher<br>P3. Replace fire extinguisher<br>P4. Ensure that the fire brigade is at stand by(for major emergency) |
| **CU4. Ensure Safeguard of Machines** | P1. Maintain radiator shield<br>P1. Maintain alternator fan shield<br>P2. Maintain heat resister material on silencer<br>P3. Cover main circuit breaker<br>P4. Lock canopy doors |
| **CU5. Adopt company policies and procedures** | P1. Ensure company's safety policy<br>P2. Adopt company safety procedure<br>P3. Advocate worker with company safety policy<br>P4. Implement Safety sign board as per standard |
| **CU6. Attain health & safety training** | P1. Take required health and safety training<br>P2. Implement work hazardous material information system (WHMIS)<br>P3. Adopt first aid cardio respiratory, resuscitation and CPR |
| **CU7. Prepare for emergencies** | P1. Take emergency response training<br>P2. Ensure practice of emergency exercises<br>P3. Check the emergency alarms<br>P4. Ensure regular practice of gathering the workers in assembly area during the emergency. |
| **CU8. Respond** | P1. Follow emergency plan |

| | |
|---|---|
| **to emergencies** | P2. Communicate instructions to co workers<br>P3. Assess risk and determine course of action<br>P4. Operate emergency equipment and supplies<br>P5. Ensure that the ambulance is at stand by(for emergency) |

**Knowledge & Understanding**

The student must have knowledge regarding:

- Company policies and procedures
- Emergency equipment, supplies and their operation
- Factors affecting Health & Safety in the workplace.
- First-Aid-Box.
- Hazardous chemical control procedures
- Methods of communication during emergency
- Methods of first aid cardio respiratory Procedure
- Methods of treatment against electric shock
- Methods of treatment against minor injuries
- Personal Protective Equipment (PPE)
- Response various types of emergencies
- Safety measures
- Types of emergencies
- Types of Fire Extinguisher
- Types of work site Hazards
- Work permit/no objection certificate(NOC)

**Tool and Equipment**

| SN | Tools |
|---|---|
| 1 | Emergency Alarm/Bell |
| 2 | Emergency response Plan |
| 3 | Fall Protection Plan |
| 4 | Fire Extinguisher |
| 5 | First Aid Box |
| 6 | Hearing protection |
| 7 | Protection suite |
| 8 | Respiratory mask |
| 9 | Safety goggles |
| 1 | Safety shoes |
| 1 | Stretcher |

**Critical Evidence(s) Required**

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

- Handle and set Lightening for Current affair program
- Types of hazards that are most likely to cause harm to health and safety
- Health and safety signs and precautions
- Techniques and methods to identify the risks of hazards at workplace
- Safety reporting procedures and documentation
- Describe fire-fighting methods
- Demonstrate use of appropriate Personal Protective Equipment (PPE) for the assigned job
- Demonstrate removal and disposal of PPE.

## 0714E&A2. Adopt Safety Regulations, Labour Protection Laws, Environmental Protection Laws at Workplace

**Overview:**

After this Competency Standard, the Trainee will be able to develop skill and competence required to maintain Occupational Safety, Health and Environment at the workplace according to the National and International Protection Agencies Standards and take remedial measures for Personal, Occupational and Environmental Protection. The Trainee will be able to deal with the emergencies in a professional manner, thus minimizing the losses and providing a safe and healthy working environment.

| Competency Units | Performance Criteria |
|---|---|
| **CU1: Implement International Safety Standards in your work environment** | P1. Recognize Electrical Safety hazards as per International Electro- Technical Commission (IEC) Standards<br>P2. Determine Environmental Pollution risk factors as per Protection Agency (EPA) standards<br>P3. Identify Electrical Safety Hazards as per Institute of Electrical and Electronics Engineers (IEE) standards<br>P4. Categorize the Electrical Safety Hazards as per Electrical Safety Foundation International(ESFI) standards<br>P5. Identify Labor Protection Laws as per International Labor Organization(ILO) rules<br>P6. Identify the steps to minimize the Electrical hazards and Environmental Pollution.<br>P7. Prepare a report for all the above activity. |
| **CU2: Implement National Safety Standards in your work environment** | P1. Identify Factory associated hazard as per Chapter 3 of Factories Act, 1934<br>P2. Determine Environmental Pollution factors as per Pakistan Environmental Protection Act, 1997<br>P3. Recognize the Labor protection laws as per Labor Protection Policy 2006<br>P4. Identify the workplace hazards as per Occupational health and safety (OHS) standards<br>P5. Identify the steps to minimize the Electrical hazards, Environmental Pollution and Labor Safety<br>P6. Prepare a report for all the above activity. |
| **CU3: Implement International and National Labor Protection Laws** | P1. Identify Labor Protection Laws as per International Labor Organization(ILO) rules<br>P2. Recognize the Labor protection laws as per Labor Protection Policy 2006<br>P3. Identify the Bonded Labor and Child Labor policy.<br>P4. Determine the leaves policy and compensation policy for the Labor.<br>P5. Recognize the minimum wage for the Labor |

| | |
|---|---|
| | P6. Identify the remedial steps for protection and prosperity of Labor.<br>P7. Prepare a report for all the above activity. |
| **CU4: Implement National and International Environmental protection laws** | P1. Determine Environmental Pollution risk factors as per Protection Agency (EPA) standards<br>P2. Identify the steps to minimize the Electrical hazards and Environmental Pollution.<br>P3. Determine Environmental Pollution factors as per Pakistan Environmental Protection Act, 1997<br>P1. Identify the requirements for Initial Environmental Examination (IEE)<br>P2. Identify the requirements for Environmental Impact Assessment (EIA)<br>P3. Prepare a report for all the above activity. |
| **CU5: Prepare for emergencies** | P1. Take emergency response training<br>P2. Ensure practice of emergency exercises<br>P3. Ensure the availability of first aid box and fire extinguisher<br>P4. Check the expiry of medicines and fire extinguishers<br>P5. Check the emergency alarms<br>P6. Ensure regular practice of gathering the workers in assembly area during the emergency. |
| **CU6: Respond to emergencies** | P1. Follow emergency plan<br>P2. Communicate instructions to co workers<br>P3. Assess risk and determine course of action<br>P4. Operate emergency equipment and supplies<br>P5. Ensure that the ambulance and fire brigade is at stand by (for major emergency) |
| **CU7: Adopt company policies and procedures** | P1. Ensure company's safety policy<br>P2. Adopt company safety procedure<br>P3. Advocate worker with company safety policy<br>P4. Implement Safety sign board as per standard |

**Knowledge & Understanding**

The student must have knowledge regarding:

- Company policies and procedures
- Emergency equipment, supplies and their operation
- Factories Act 1934
- Factors affecting Health & Safety in the workplace.
- First-Aid-Box.
- Hazardous chemical control procedures
- IEC/EPA/IEE/ESFI Standards
- Labor Protection Policy 2006
- Methods of communication during emergency
- Methods of first aid cardio respiratory Procedure

- Methods of treatment against electric shock
- Methods of treatment against minor injuries
- Occupational health and safety (OHS) standards
- Pakistan Environmental Protection Act, 1997
- Personal Protective Equipment (PPE)
- Response various types of emergencies
- Safety measures
- Types of emergencies
- Types of work site Hazards
- Understand various safe guards
- Uses of Fire Extinguisher
- Work permit/no objection certificate(NOC

**Tool and Equipment**

| |
|---|
| **Emergency Alarm/Bell** |
| **Protection suite** |
| **Emergency response Plan** |
| **Fall Protection Plan** |
| **Fire Buckets** |
| **Fire Extinguisher** |
| **Hearing protection** |
| **International Safety Standards Manual** |
| **National Safety Standards Manual** |
| **Respiratory mask** |
| **Safety goggles** |
| **Safety shoes** |
| **Stretcher** |
| **WHMIS Handbook** |

**Critical Evidence(s) Required**

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

Handle and set Lightening for Current affair program:

- Types of hazards that are most likely to cause harm to health and safety
- Health and safety precautions
- Health and safety signs and symbols
- Techniques and methods to identify the risks of hazards at workplace
- Dealing with hazards to avoid any accident or injury
- Safety reporting procedures and documentation

- Describe fire-fighting methods
- Demonstrate use of appropriate Personal Protective Equipment (PPE)

## 0714E&A3- Develop Professionalism

**Overview:**

This competency standard covers the skills and knowledge required to Demonstrate work ethic, Aware of factors affecting personal health, Resolve problems or disagreements with others, participate in professional development, Work with others, Work independently, Speak and listen effectively, interpret documentation, communicate using signals, and communicate Using electronic equipment.

| Competency Units | Performance Criteria |
|---|---|
| **CU1. Demonstrate work ethic** | P1. Follow principles of work ethics in all situations<br>P2. Adopt professional behavior |
| **CU2. Select factors affecting personal health** | P1. Follow factors affecting personal health<br>P2. Aware about the situations/conditions that cause stress in professional and personal life |
| **CU3. Resolve problems or disagreements with others** | P1. Communicate effectively<br>P2. Adopt peaceful approach<br>P3. Regulate cause of problem or disagreement<br>P4. Resolve issues |
| **CU4. Participate in professional development** | P1. Assess own knowledge and skills<br>P2. Acquire information about training opportunities<br>P3. Adopt to Learn through various methods, such as on job training, reading, courses and co-workers |
| **CU5. Work with others** | P1. Work as a team member to achieve common goals<br>P2. Keep mind open.<br>P3. Participate in work place meetings<br>P4. Communicate accurately and clearly<br>P5. Co-ordinate job related activities<br>P6. Cooperate with others |
| **CU6. Work independently** | P1. Confirm and clarify assignment<br>P2. Take initiative, anticipate and prepare for next steps in job<br>P3. Identify and resolve potential and actual problems<br>P4. Communicate with other site personnel<br>P5. Complete assignment |
| **CU7. Speak and listen effectively** | P1. Listen carefully to Explain said<br>P2. Confirm understanding, such as repeat instructions<br>P3. Communicate message clearly and accurately to others<br>P4. Exchange information with others, such as supervisor, signaler, general public, inspectors, other operators and trade people |
| **CU8. Interpret documentation** | P1. Access and maintain documents<br>P2. Provide complete, legible and accurate information in documents<br>P3. Interpret equipment inspection documentation from previous shifts before conducting pre-operational inspection |

| | |
|---|---|
| **CU9. Communicate with signals** | P1. Identify and work with signals<br>P2. Communicate with audible signals, such as back-up alarm, and site emergency horn<br>P3. Communicate with hand signals |
| **CU10. Communicate with electronic equipment** | P1. Check communication devices to verify operating condition, such as complete radio checks<br>P2. Deliver and receive messages using communication equipment<br>P3. Follow communication protocol |

**Knowledge & Understanding**
The student must have knowledge regarding:

- Applicable legislation, such as harassment
- Audible and warning signals used on job site
- Conflict resolution techniques.
- Explain Principles of work ethic and expectations.
- Factors/situations/conditions that cause stress in professional and personal life
- Impact of fatigue on job performance.
- Importance of complete, legible, and accurate documentation
- Importance of effective communication
- Own role and responsibilities
- Role and responsibilities of signalers
- Roles of individuals on job site, such as supervisor, inspector, other trades people
- Types of communication equipment used on job site
- Types of documentation required, such as log books, safety reports, maintenance reports, inspection reports, time cards
- Work assignment, location, and working conditions

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

- Handle and set Lightening for Current affair program Own current mental, emotional, and physical state.
- Working conditions on construction site.
- Effective communication.
- Maintain log books, safety reports, maintenance reports, inspection reports, time cards

- Signalers on job site
- Audible and warning signals used on job site
- Communication equipment used on job site

***Principles of Electrical & Electronics***

## 0714E&A3. Verify the DC Fundamentals

**Overview**

After this competency standard the student will be able to identify variety of circuits related to DC Fundamentals and their usage in industry.

| Competency Units | Performance Criteria |
|---|---|
| **1. Verify Ohm's Law** | P1. Identify the Resistor<br>P2. Calculate the resistance of available resistor via Color coding chart<br>P3. Draw the different* circuits with the aid of Resistors.<br>P4. (Series Circuit, Parallel Circuit, Series-Parallel Circuit)<br>P5. Interface the resistor with LED for demonstrating the Ohm's Law.<br>P6. Install the Voltmeter, Ammeter and Wattmeter in Resistors based circuits for calculations of results and parameters. |
| **2.Implement the variable resistor as a potentiometer and Rheostat** | P1. Identify the Variable Resistor Read the value of Resistor also measure by using Multi-meter.<br>P2. Connect variable resistor with Multi-meter and check the resistance variation by using viper of Variable Resistor of good condition of variable resistor.<br>P3. Use variable resistor to control the DC motor voltage level<br>P4. Connect variable resistor with DC motor for controlling the current level of motor. |
| **3.Use inductors in circuit** | P1. Classify the inductor and its types<br>P2. Use inductors in series and parallel circuits<br>P3. Draw LC Circuit for demonstration of LC affects.<br>P4. Calculate capacitance of capacitor and inductor circuits theoretically and practically.<br>P5. Use inductance as a damping circuit |
| **4.Use capacitors in electrical circuits** | P1. Classify the capacitors, its types and capacity.<br>P2. Use Capacitors in series and parallel circuits<br>P3. Draw RC Circuit for demonstration of ON/OFF Delay and Decayed Timer circuits.<br>P4. Calculations of capacitor based circuits theoretically and practically. |
| **5.Apply theorems on circuits** | P1. Apply Kirchhoff's Current Law on circuits for developing the concept effectively.<br>P2. Apply Kirchhoff's Voltage Law on circuits for developing the concept effectively. |

| | |
|---|---|
| | P3. Apply superposition theorem on circuits for developing the concept effectively.<br>P4. Apply maximum power transfer theorem on circuits for developing the concept effectively.<br>P5. Apply thevenin's theorem on circuits for developing the concept effectively.<br>P6. Apply Norton's theorem on circuits for developing the concept effectively<br>P7. Apply Mesh theorem on circuits for developing the concept effectively.<br>P8. Star Delta and Delta Star Transformations of circuits. |
| **6.Apply Heat and Light sensors in circuits** | P1. Design an LDR based Dark/Light detector circuit.<br>P2. Design a thermistor (NTC or PTC) based Heat Sensor circuit. |

**Knowledge and understanding:**

- Understand Capacity of resistance and its types
- Understand Heat and Light sensors and their types
- Understand Multi-meter & power Supply AC/DC
- Understand Resistor and its types
- Understand the capacitor and its types
- Understand the Color coding chart of Resistor
- Understand the data manual, Capacitors chart
- Understand the inductor and its types
- Understand the KVL, KCL, superposition theorem, maximum power transfer theorem, thevenin's theorem, Norton's theorem, Mesh theorem, star delta and delta star transformations.
- Understand the procedure for using variable resistor as a potentiometer
- Understand the procedure for using variable resistor as a Rheostat/variable control
- Understand the procedures for implementation of theorems on circuits

**Tools & Equipment**

| SN | |
|---|---|
| **1.** | Chart of Resistors |
| **2.** | Digital Trainer box |
| **3.** | Variable Resistors |
| **4.** | Inductors |
| **5.** | Power supply AC/DC |

| **Critical Evidence(s) Required** |
|---|

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

Evidence of the following is essential:

- Verify Ohm's law
- Design a Thermistor

## 0714E&A4. Apply the AC Fundamentals

**Overview**

After this competency standard the student will be able to identify variety of circuits related to AC Fundamentals and their usage in industry.

| Competency Units | Performance Criteria |
|---|---|
| **Measure Alternating Current and Voltage** | Perform a task on electric board & three phase panel via Multi-meter<br>Identify the AC and DC Voltage.<br>Differentiate the AC and DC Generator practically via suitable task |
| **Analyze the AC Circuits** | Perform a task with AC loads (resistive, capacitive and inductive).<br>Calculate the AC parameters<br>Perform a task for understanding RLC Series and Parallel circuits with AC source.<br>Demonstrate the resonance in parallel and series circuits & calculate the related parameters. |

**Knowledge and understanding**

- Understand Alternating Current and Voltage.
- Understand the principle working of AC and DC generator and their applications.
- Understand multi-meter & power Supply.
- Understand the principle parameters of AC Circuits
- Understand multi-meter, sequence tester, megger & power Supply.
- AC/DC Clamp meter

**Tools & Equipment**

| SN | |
|---|---|
| **1.** | Megger |
| **2.** | Power supply |
| **3.** | Phase sequence tester |
| **4.** | Trainer and Multi-meter |
| **5.** | AC/DC Clamp meter |

**Critical Evidence(s) Required**

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

Evidence of the following is essential:

- Analyze phase sequence
- Measure voltage, current and power using clamp meter

## 0714E&A5. Install Relays and Switches in various domestic and Industrial circuits

**Overview:**
After this competency standard the student will be able to identify variety of relays and switches and their usage in industry.

| Competency Units | Performance Criteria |
|---|---|
| **1. Implement Relays in circuits** | Design a circuit which can automate the DC load by using SSR and mechanical Relays.<br>Design a circuit which can automate the DC load and AC load by using Dpdt Relay. |
| **2.Implement switches** | Design a circuit which can cutoff the DC load by using Limit switch.<br>Design a circuit which can cutoff the DC load and AC load by using Spdt switch. |

### Knowledge and understanding

Knowledge about Relay and its types
Understand multi-meter & power Supply
Understand Multi-meter & power Supply

### Tools & Equipment

| SN | |
|---|---|
| **1.** | Multi-meter |
| **2.** | Power supply |
| **3.** | Relays(SSR AC to AC) |
| **4.** | Relays(SSR AC to DC) |
| **5.** | Digital Trainer |
| **6.** | AC/DC Clamp meter |

### Critical Evidence(s) Required

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

Evidence of the following is essential:

- Draw circuit diagram of limit switch
- Measure the resistance by Multi meter

## 0714E&A6. Install Different types of Transformers

**Overview**

After this competency standard the student will be able to identify variety of transformers and their usage in industry.

| Competency Units | Performance Criteria |
|---|---|
| **CU1. Use transformer with diode** | P1. Design a circuit which can perform the half wave rectification with the help of diode and transformer.<br>P2. Design a circuit which can perform the full wave rectification with the help of bridge rectifier and transformer.<br>P3. Record their waveforms on digital oscilloscope. |
| **CU2. Make Star and Delta connection of three phase transformer** | P1. Plan a delta connection on primary side of transformer and star connection on secondary side of transformer<br>P2. Demonstrate the PMT.<br>P3. Record waveforms and parameters. |

**Knowledge and understanding**

- Knowledge about transformer and its types
- Knowledge of oscilloscope
- Knowledge about three phase transformer and its types
- Understand Multi-meter & megger.

**Tools & Equipment**

| SN | |
|---|---|
| **1.** | Transformers and diodes |
| **2.** | Multimeter |
| **3.** | Power supply |
| **4.** | Digital Oscilloscope |
| **5.** | Megger |

**Critical Evidence(s) Required**

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

Evidence of the following is essential:

- Make step-up transformer

***Computer Applications***

**0714E&A7. Apply Basic Computer skills to create a variety of Document**

**Overview:**

| Competency Units | Performance Criteria |
|---|---|
| **CU1. Determination of computer requirements and assemble procedures** | P1. Classify the hardware components of Computer.<br>P2. Assemble the motherboard and other peripherals in casing.<br>P3. Install the computer software for operations of peripherals. |
| **CU2. Installation, Testing and inspection of operating system and applications.** | P1. Install the required operating System with Device drivers.<br>P2. Install and execute test of required Application Software<br>P3. Install the necessary plug-ins and other software's and Making the Ghost of Hard Disk and data recovery<br>P4. Check the appropriate operation and execution of system as per standard and demonstrate the test results for the (system requirements) customer satisfaction. |
| **CU3. Apply Input Methods and Execute Basic Computer Operations** | P1. Record the speed, accuracy via utilizing keyboarding techniques.<br>P2. Use system tools and program interface<br>P3. Utilize resources to obtain assistance<br>P4. Implement proper network user I.D and procedures, protocol<br>P5. Identify the file formats and extensions.<br>P6. Copy, Paste and send to data from various sources or storage devices<br>P7. Design a (requirement) paperwork to purchase a computer using hardware and software specifications<br>P8. Installation of drivers according to system requirement. |
| **CU4. Prepare/Construct Documents using Spreadsheet Applications** | P1. Create, design, Format and edit spreadsheets, charts and graphs<br>P2. Create basic functions/formulas<br>P3. Manipulate multiple worksheets in a workbook<br>P4. Apply advanced functions/formulas |
| **CU5. Construct (prepare) Documents using power point presentation/ Applications** | P1. Demonstrate oral presentation Using a specified slide number, duration and a selected theme and back ground<br>P2. Design, create, and deliver a self-running electronic slideshow<br>P3. Design &create Effective Power Point Presentation using advance features. |

| | |
|---|---|
| **CU6. Construct (prepare) Documents using Database Applications** | P1. Create and manipulate a database<br>P2. Modify database using queries<br>P3. Use import/export features<br>P4. Construct Business Documents using Presentation Applications<br>P5. Apply design and layout principles to presentations |
| **CU7. Use the Communication Networks** | P1. Integrate input from software applications<br>P2. Design the Online Classroom Portals<br>P3. Exercise internet surfing.<br>P4. Identify copyright principles before accepting<br>P5. Utilize online productivity tools<br>P6. Apply the security applications. |

**Knowledge and understanding**

- Describe the basic input and out devices and their use.
- Describe the basics of PDF reports, Web publishing and Ribbon interface.
- Describe the client-server databases.
- Describe the facts of internet applications and usages of online communication.
- Explain the basic hardware configuration required for operating software.
- Explain the basics of creating documents in Spreadsheet in Excel, word and PDF Applications.
- Explain the concepts of public domain, copy protection, licensing etc.
- Explain the database import/export to other Office apps.
- Explain the safe internet browsing.
- Understand computer requirements.
- Understand the installation and configuration procedures of computer hardware and operating system
- Understand the uses and functions/formulas, charts and graphs
- Understand, creating the PowerPoint presentations, Formatting and editing, adding, subtracting slide text etc.

**Tools & Equipment**

| **SN** | |
|---|---|
| **1** | Videos/ Demos |
| **2** | Computer Accessories |
| **3** | Presentations |

**Critical Evidence(s) Required**

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

Evidence of the following is essential:

- Generate Spreadsheet
- Prepare presentation on Power point
- Perform Internet Browsing

## Basic Electrical Wiring (Single Phase)

**0714E&A8. Maintain Tools & Equipment.**

**Overview**: This competency standard covers the skills and knowledge related to arrange tools/equipment, maintain tool box, insulate tools/equipment, calibrate measuring tools and manage proper inventory of used/unused tools/equipment. Trainee will be expected to follow the procedures to maintain the tools/equipment.

| Competency Unit | Performance Criteria |
|---|---|
| CU1. Arrange Tools and Equipment | **P1.** Identify tools and equipment<br>**P2.** Interpret job card<br>**P3.** Prepare list of tools and equipment as per requirement<br>**P4.** Collect tools and equipment from store |
| CU2. Maintain Tool Box | **P1.** Check physical conditions of tools and equipment before use<br>**P2.** Perform preventive maintenance as per standards<br>**P3.** Perform corrective maintenance of tools as per requirements<br>**P4.** Clean tools and equipment after use<br>**P5.** Place tools and equipment at appropriate place |
| CU3. Insulate Tools and Equipment | **P1.** Select insulated tools and equipment<br>**P2.** Adopt insulated tools and equipment as per standards |
| CU4. Calibrate measuring tools | **P1.** Check calibration status of the measuring tools<br>**P2.** Perform calibration of measuring tools as per standards<br>**P3.** Record calibration test results |
| CU5. Manage Inventory of tools and equipment | **P1.** Check tools and equipment as per record<br>**P2.** Report for faulty tools and equipment to supervisor<br>**P3.** Generate demand for deficit tools and equipment<br>**P4.** Maintain all records of tools and Equipment |

### 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:

- Explain Various tools and equipment and their functions
- Define Job card/work order
- Arrangement of tools/equipment as per job is required
- Differentiate between corrective and preventive maintenance
- Arrange tools and equipment in tool box

- Storage methods of tools and equipment
- Insulation procedure
- Types of insulation
- Methods of insulated tools and equipment.
- Types of calibration
- Methods of equipment calibration
- Methods of tools and equipment inventory
- Report writing of faulty tools and equipment

## Critical Evidence(s) Required

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

- Describe functions of various tools and equipment
- Define job card
- Perform storage of tools and equipment at appropriate
- Describe Types of insulation
- Use of insulated tools and equipment
- Describe method of equipment calibration
- Perform Report writing

### Tools and Equipment

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

| S. No. | Items |
|---|---|
| 1. | Cables |
| 2. | Wires. |
| 3. | Wire stripper. |
| 4. | Solder wire. |
| 5. | Soldering paste |
| 6. | Plier. |
| 7. | Nose plier. |
| 8. | Insulation remover. |
| 9. | Solder. |

## 0714E&A9. Make Cable/Wire Joints

**Overview**: This competency standard covers the skills and knowledge related to make joints of cable during wiring and breakage of wires, Make Cross/Twist joint, Make Straight/Married joint, Make T- Joint, Make Rat tail joint, Make Britannia joint.

| Competency Unit | Performance Criteria |
|---|---|
| CU1. Make Cross/Twist joint | **P1.** Select the cable.<br>**P2.** Strip the wire according to 50mm.<br>**P3.** Twist the conductors.<br>**P4.** Solder the conductor<br>**P5.** Insulate the joint |
| CU2. Make Straight/Married joint | **P1.** Select the cable.<br>**P2.** Strip wire to 75mm according to joint requirement.<br>**P3.** Intermingle the conductors to 60mm into each other.<br>**P4.** Twist 60mm conductors leaving behind 15mm of each cable.<br>**P5.** Solder the conductor.<br>**P6.** Insulate the joint. |
| CU3. Make T-Joint | **P1.** Select the cable<br>**P2.** Remove the insulation of cable 1 to 50mm from where a connection is required<br>**P3.** Separate conductors of cable 1 equally<br>**P4.** Take another 12 mm stripped wire 2<br>**P5.** Insert between two equally half conductors of cable 1 and twist. Half conductors clockwise and half anti-clock wise of cable 2<br>**P6.** Solder the joint |
| CU4. Make Rat tail joint | **P1.** Select the single conductor wires<br>**P2.** Strip both the wires to 5mm<br>**P3.** Twist the conductor<br>**P4.** Insulate the joint<br>**P5.** Solder the joint |
| CU5. Make Britannia joint | **P1.** Select the cable.<br>**P2.** Strip both cables to 75mm.<br>**P3.** Bend the tips of both cable right angle about to 6mm.<br>**P4.** Hold the two cables overlap 50mm with tips in opposite direction.<br>**P5.** Take another bare conductor of 1mm and wrap around in both directions to 6mm.<br>**P6.** Solder the joint.<br>**P7.** Insulate the joint. |

**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:

- Define conductor.
- Differentiate between cable and wire.
- Describe the type of soldering.
- Differentiate between stripping and insulation removing.
- Describe the type of joints.
- Describe the procedure of jointing & soldering.
- Explain the composition of solder and soldering flux
- Define Britannia joint

## Critical Evidence(s) Required

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

- Perform Striping of cables.
- Perform Twisting of cable.
- Perform Soldering of joints

### Tools and Equipment

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

| S. No. | Items |
|---|---|
| 1. | Cables |
| 2. | Wires. |
| 3. | Wire stripper. |
| 4. | Solder wire. |
| 5. | Soldering paste |
| 6. | Plier. |
| 7. | Nose plier. |
| 8. | Insulation remover. |
| 9. | Solder. |

## 0714E&A10. Prepare and Install Distribution Boards

**Overview**: This competency standard covers the skills and knowledge required to prepare and install distribution board according to provide protection and load division to wiring, prepare estimate for wiring material, Prepare Distribution Board, Install Distribution Board and wiring.

| Competency Unit | Performance Criteria |
|---|---|
| CU1. Prepare estimate for wiring material. | **P1.** Develop Basic Drawing<br>**P2.** Perform Estimation of Materials<br>**P3.** Calculate Labour Cost |
| CU2. Prepare Distribution Board | **P1.** Select Distribution board w.r.t. size, current rating, voltage, No. of C.Bs and phases<br>**P2.** Select Main Incoming Residual Current Circuit Breaker (RCCB) having minimum sensitivity<br>**P3.** Select outgoing Miniature Circuit Breaker (MCB) according to load<br>**P4.** Provide space for future MCB<br>**P5.** Select Voltmeter, ampere meter and indicator according to load and phases<br>**P6.** Select wire according to load and for wiring in Distribution Board (DB)<br>**P7.** Make neutral common for all load<br>**P8.** Connect accessories according to the circuit diagram |
| CU3. Install Distribution Board and wiring | **P1.** Fix the distribution board<br>**P2.** Take wire from DB to load without joint<br>**P3.** Distribute load equally on all phases |

**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:

- Define distribution board.
- Describe D.B. w.r.t. size, current rating, voltage, No. of C.Bs and phases etc.
- Define sensitivity of RCCB.
- Define MCB.
- Differentiate fuse and breaker.
- Define wiring accessories
- State purpose of each accessory.

**Critical Evidence(s) Required**

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

- Use accurate Miniature Circuit Breaker (MCB) for load.
- Make a common neutral.
- Identify parts of distribution board.
- Develop Bill of Quantity (BOQ).

**Tools and Equipment**

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

| S. No. | Items |
|---|---|
| 1. | Cables |
| 2. | Wires. |
| 3. | Wire stripper. |
| 4. | Solder wire. |
| 5. | Soldering paste |
| 6. | Plier |
| 7. | Nose plier. |
| 8. | Insulation remover. |
| 9. | Solder. |
| 10. | MCB |
| 11. | MCCB |
| 12. | RCD |
| 13. | ELCB |
| 14. | DB |
| 15. | Socket and switches |

## 0714E&A11. Carryout Basic Electrical Installation

**Overview**: This competency standard covers the skills and knowledge required to lay cables, perform single & three phase connections, basic electric wiring and wiring test for carrying out basic electrical Air Condition (AC) installation. The trainee will be required to follow company guidelines as well as the procedure for carrying out basic electrical AC installation.

| Competency Units | Performance Criteria |
|---|---|
| **CU1.** Perform Basic Electrical wiring | P1. Measure cables as per requirement<br>P2. Connect cables<br>P3. Perform joints<br>P4. Insulate Joints |
| **CU2.** Conduct wiring Test | P1. Operate multi-meter for voltage and current<br>P2. Perform continuity test<br>P3. Perform polarity test<br>P4. Perform earthling test<br>P5. Perform insulation test<br>P6. Record test results |
| **CU3.** Lay cables | P1 Interpret electrical drawing/ document<br>P2. Identify cables<br>P3. Lay cables<br>P4. Perform earthling |
| **CU4.** Perform single-phase Connection | P1. Select cable gauge<br>P2. Select cables colors<br>P3. Connect cables<br>P4. Insulate Joints |
| **CU5.** Perform three phase Connection | P1. Select cable Gauge<br>P2. Select cables colors<br>P3. Connect cables |

| | |
|---|---|
| | P4. Insulate Joints |

**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:

- Explain Types of cables
- Explain Gauges of cables
- Define single phase connection
- Describe Types of joints
- Define conductor and insulator
- Define three phase connection
- Describe cable gauging
- Describe color code of cables / phase sequence.
- Define Methods of Wiring
- Describe Types of wiring
- Describe Types of connections
- Describe Types of wiring tests
- Describe various wiring test
- Describe Color of cables
- Distinguish between different wiring systems
- Describe necessary materials required for each type of wiring.
- Explain the uses of each type of wiring.

**Critical Evidence(s) Required**

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

- Perform Single phase connection
- Perform Three phase connection
- Identify Color code of cables / Phase sequence
- Identify Cable gauging
- Identify Types of wiring
- Identify Types of connections

**Tools and Equipment**

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

| S. No. | Items |
|---|---|
| 1. | Cables |
| 2. | Solder |
| 3. | Wire stripper |
| 4. | Plier |
| 5. | Wires |

6. Nose plier
7. Solder wire
8. Soldering paste
9. Insulation remover

## 0714E&A12. Install Simple Electrical Wiring

**Overview**: This competency standard covers the skills and knowledge required to make single pole switch circuit, make single pole switch socket circuit, make two-way switch circuit, make series/test lamp circuit. Make intermediate switch circuit. Make of Tunnel circuit, Make of impulse switch circuit.

| Competency Unit | Performance Criteria |
|---|---|
| CU1. Make single pole switch circuit. | **P1.** Draw wiring diagram of single pole switch circuit.<br>**P2.** Draw Current path diagram of single pole switch circuit.<br>**P3.** Draw layout diagram of single pole switch circuit.<br>**P4.** Mark on working board according to layout diagram.<br>**P5.** Install accessories according to layout diagram.<br>**P6.** Lay wires in duct/pipe according to layout diagram.<br>**P7.** Make connections according to wiring diagram.<br>**P8.** Check the circuit before connect the main supply.<br>**P9.** Make connection with main supply.<br>**P10.** Check the function of circuit after connect the main supply |
| CU2. Make single pole switch socket circuit. | **P1.** Draw wiring diagram of single pole switch socket circuit.<br>**P2.** Draw Current path diagram of single pole switch socket circuit.<br>**P3.** Draw layout diagram of single pole switch socket circuit.<br>**P4.** Mark on working board according to layout diagram.<br>**P5.** Install accessories according to layout diagram.<br>**P6.** Lay wires in duct/pipe according to layout diagram.<br>**P7.** Make connections according to wiring diagram.<br>**P8.** Check the circuit before connect the main supply.<br>**P9.** Make connection with main supply.<br>**P10.** Check the function of circuit after connect the main supply |
| CU3. Make two-way switch circuit. | **P1.** Draw wiring diagram of two-way switch circuit.<br>**P2.** Draw Current path diagram of two-way switch circuit.<br>**P3.** Draw layout diagram of two-way switch circuit.<br>**P4.** Mark on working board according to layout diagram.<br>**P5.** Install accessories according to layout diagram.<br>**P6.** Lay wires in duct/pipe according to layout diagram.<br>**P7.** Make connections according to wiring diagram.<br>**P8.** Check the circuit before connect the main supply.<br>**P9.** Make connection with main supply.<br>**P10.** Check the function of circuit after connect the main |

| | |
|---|---|
| | supply |
| CU4. Make series/test lamp circuit. | **P1.** Draw wiring diagram of series circuit.<br>**P2.** Draw Current path diagram of series circuit.<br>**P3.** Draw layout diagram of series circuit.<br>**P4.** Mark on working board according to layout diagram.<br>**P5.** Install accessories according to layout diagram.<br>**P6.** Lay wires in duct/pipe according to layout diagram.<br>**P7.** Make connections according to wiring diagram.<br>**P8.** Check the circuit before connect the main supply.<br>**P9.** Make connection with main supply.<br>**P10.** Check the function of circuit after connect the main supply |
| CU5. Make intermediate switch circuit. | **P1.** Draw wiring diagram of intermediate switch circuit.<br>**P2.** Draw Current path diagram of intermediate switch circuit.<br>**P3.** Draw layout diagram of intermediate switch circuit.<br>**P4.** Mark on working board according to layout diagram.<br>**P5.** Install accessories according to layout diagram.<br>**P6.** Lay wires in duct/pipe according to layout diagram.<br>**P7.** Make connections according to wiring diagram.<br>**P8.** Check the circuit before connect the main supply.<br>**P9.** Make connection with main supply.<br>**P10.** Check the function of circuit after connect the main supply |
| CU6. Make of Tunnel circuit | **P1.** Draw wiring diagram of tunnel circuit.<br>**P2.** Draw Current path diagram of tunnel circuit.<br>**P3.** Draw layout diagram of tunnel circuit.<br>**P4.** Mark on working board according to layout diagram.<br>**P5.** Install accessories according to layout diagram.<br>**P6.** Lay wires in duct/pipe according to layout diagram.<br>**P7.** Make connections according to wiring diagram.<br>**P8.** Check the circuit before connect the main supply.<br>**P9.** Make connection with main supply.<br>**P10.** Check the function of circuit after connect the main supply |
| CU7. Make impulse switch circuit. | **P1.** Draw wiring diagram of impulse switch circuit.<br>**P2.** Draw Current path diagram of impulse switch circuit.<br>**P3.** Draw layout diagram of impulse switch circuit.<br>**P4.** Mark on working board according to layout diagram.<br>**P5.** Install accessories according to layout diagram.<br>**P6.** Lay wires in duct/pipe according to layout diagram.<br>**P7.** Make connections according to wiring diagram.<br>**P8.** Check the circuit before connect the main supply.<br>**P9.** Make connection with main supply.<br>**P10.** Check the function of circuit after connect the main supply |

**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:

- Define single pole switch.
- Explain single pole switch circuit and its use.
- Define current, voltage, power and resistance.
- Describe two-way circuit.
- Define two-way switch
- Define single pole switch.
- Explain impulse switch circuit and its use.
- Describe socket.
- Define series circuit.
- Define parallel circuit.
- Define impulse switch.
- Define push button.

## Critical Evidence(s) Required

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

- Perform intermediate switch circuit connections.
- Perform single pole switch circuit connections.
- Define current, voltage, power and resistance.
- Explain impulse switch circuit and its use.

**Tools and Equipment**

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

| S. No. | Items |
|---|---|
| 1. | Electrician Tool kit. |
| 2. | PVC Pipe/Duct. |
| 3. | PVC clamp. |
| 4. | Wooden/PVC board. |
| 5. | PVC wire according to load |
| 6. | Circuit Breaker. |
| 7. | Screw |
| 8. | Single pole switch. |
| 9. | Lamp holder |
| 10. | Lamp |
| 11. | AVO meter. |
| 12. | Test Indicator |

## 0714E&A13. Perform Testing of Electrical Wiring

**Overview**: This competency standard covers the skills and knowledge required to Perform Earth leakage Test, Perform Open Circuit Test, Perform Short Circuit Test, Perform Continuity/Loop Test, Perform Visual Test, Perform Insulation Test, Perform Polarity Test, Perform Earth Resistance Test, Perform Murray Loop Test, and Perform BLAVIER & Earth Loop Test.

| Critical Evidence | Performance Criteria |
|---|---|
| **CU1. Perform Open Circuit Test** | **P1.** Disconnect the power supply source, neutral conductor and earth conductor from distribution fuse box.<br>**P2.** Connect ohmmeter between starting and ending terminals of live conductor.<br>**P3.** Ensure that the reading should be close to 0 ohm.<br>**P4.** Repeat P2 to P3 for neutral and earth conductor. |
| **CU2. Perform Short Circuit Test** | **P1.** Disconnect the supply source, neutral conductor and earth conductor from distribution fuse box.<br>**P2.** Connect one terminal of ohmmeter with live conductor.<br>**P3.** Connect the other terminals of ohmmeter with neutral conductor.<br>**P4.** Ensure the reading must be infinity (No reading).<br>**P5.** Connect ohmmeter between live conductor and earth conductor.<br>**P6.** Ensure the reading must be infinity (No reading) |
| **CU3. Perform Continuity/Loop Test** | **P1.** Connect all metal clad switches, metal parts, conduits with earth.<br>**P2.** Open the main switch.<br>**P3.** Turn on all the switches.<br>**P4.** Connect earth continuity tester with conduit and earth.<br>**P5.** Measure the resistance value with tester which must not be more than 1 ohm. |
| **CU4. Perform Visual Test** | **P1.** Check the wires joints.<br>**P2.** Check if there is any spark.<br>**P3.** Check over heating of wires.<br>**P4.** Check all the appliances are On or fluctuating.<br>**P5.** Check all indications of meters.<br>**P6.** Check Voltages on all phases. |

| | |
|---|---|
| | **P7.** Check the DB and Breakers.<br>**P8.** Check the main supply is coming properly. |
| **CU5. Perform Insulation Test** | **P1.** Switch off the main breaker.<br>**P2.** Short circuit all lighting connections.<br>**P3.** Connect megger between line and earth.<br>**P4.** Rotate the megger to generate the voltage.<br>**P5.** Read the megger dial and ensure that the insulation resistance should not be less than 50M ohm of any single circuit. |
| **CU6. Perform Polarity Test** | **P1.** Switch off the main switch.<br>**P2.** Disconnect all loads.<br>**P3.** Switch on all circuit control switches.<br>**P4.** Connect ohm meter between main line and all the terminal of sockets and load points one by one.<br>**P5.** Ensure meter reading value must be less than 1 ohm. |
| **CU7. Perform Earth Resistance Test** | **P1.** Place 3 electrodes in earth at distance of 10m apart between every electrode.<br>**P2.** Connect terminal E of earth resistance tester to first electrode.<br>**P3.** Connect terminal P of earth resistance tester to the second electrode.<br>**P4.** Connect terminal C of the earth resistance tester with third electrode.<br>**P5.** Measure the resistances after applying specific voltage.<br>**P6.** Repeat P1 to P5 by interacting earthing regions.<br>**P7.** Ensure 3 readings must be equal. |
| **CU8. Perform Earth leakage Test.** | **P1.** Ensure the socket must be at least 13A for RCD plug in ??.<br>**P2.** Adjust the sensitivity of RCD.<br>**P3.** Ensure tripping time should not exceed from 200 msec.<br>**P4.** Plug the RCD in socket and switch on socket outlet.<br>**P5.** Ensure P-N and P-E light up.<br>**P6.** Press the test button.<br>**P7.** Ensure that RCD will trip and reading should not be less than 200 msec.<br>**P8.** Move the selection switch to $180^{o}$.<br>**P9.** Press the test button. |

| | |
|---|---|
| | **P10.** Ensure that RCD will trip and reading should not be less than 200msec.<br>**P11.** Move selection switch to $0^0$.<br>**P12.** Press the test button.<br>**P13.** Ensure that RCD will trip and reading must be shown less than 200msec. |
| **CU9. Perform Murray Loop Test** | **P1.** Connect galvanometer with Wheatstone bridge.<br>**P2.** Connect positive terminal of DC source with Wheatstone bridge.<br>**P3.** Connect negative terminal of DC source with ground.<br>**P4.** Connect remaining two terminal of Wheatstone bridge with two cores of the cable.<br>**P5.** Short the other end of these two cores of cable.<br>**P6.** Note the reading of galvanometer.<br>**P7.** Calculate Rx.<br>**P8.** Repeat the P1 to P7 for other cores of the cable. |
| **CU10. Perform BLAVIER & Earth Loop Test** | **P1.** Connect galvanometer with Wheatstone bridge.<br>**P2.** Connect positive terminal of DC source with Wheatstone bridge.<br>**P3.** Connect negative terminal of DC source with ground.<br>**P4.** Connect remaining two terminal of Wheatstone bridge with two cores of the cable.<br>**P5.** Short the other end of these two cores of cable.<br>**P6.** Note the reading of galvanometer.<br>**P7.** Calculate Rx.<br>**P8.** Repeat the P1 to P7 for other cores of the cable. |

**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:

- Define RCD
- Define sensitivity
- Explain P-E and P-N
- Explain the function of RCD.
- Explain the function of distribution box.
- Explain the function of fuse.
- Explain which meters are used for open circuit and short circuits test.
- Explain the purpose of continuity test.

- Explain the purpose of polarity test.
- Explain the purpose of insulation resistance test.

**Critical Evidence(s) Required**

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

- Perform Earth leakage Test, Open Circuit Test, Short Circuit Test, Continuity/Loop Test,
- Perform Visual Test, Perform Insulation Test, Perform Polarity Test,
- Perform Earth Resistance Test, Perform Murray Loop Test,
- Perform BLAVIER & Earth Loop Test

**Tools and Equipment**

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

| S. No. | Items |
|---|---|
| 1. | Sockets |
| 2. | RCD |
| 3. | Loads |
| 4. | Supply source |
| 5. | Distribution Box |
| 6. | Ohmmeter |
| 7. | Earth resistance tester |
| 8. | Continuity |
| 9. | Tester. |
| 10. | Breakers |
| 11. | Magger |

## 0714E&A14. Repair/ Maintenance of Electrical Installations

**Overview**: This competency standard covers the skills and knowledge required to Analyse Fault in Electrical Installations, troubleshooting of electrical equipment's and Carry out Preventive Maintenance. Carry out repair and maintenance of electrical installations at workplace in accordance with the manufacturer's instructions and organizational requirements.

| Competency Unit | Performance Criteria |
|---|---|
| CU1. Analyze Fault in Electrical Installations & Troubleshooting of | **P1.** Inspect visually the electrical wiring, fixtures, equipment, soldering, connection, appliances and machinery for discovering the faults and defects<br>**P2.** Check the installation for consistency with the |

| | |
|---|---|
| electrical equipment's | electrical drawing<br>**P3.** Draw the layout of equipment's before disassembling of electrical components<br>**P4.** Check the faulty components with scope or meter<br>**P5.** Re assembled the components as per drawing and the installation<br>**P6.** Check the fault indication at relay for HT installation<br>**P7.** Test electrical equipment as specified in the manufacturer's manual and record the results<br>**P8.** Prepare a list of items/material(s) required for repair /replacement as per specifications<br>**P9.** Draw circuit diagram of electrical equipment be disassembling<br>**P10.** Make necessary adjustments in the control and protective switchgear<br>**P11.** Replace defective control & protective switch gear, cables and accessories with standard items<br>**P12.** Replace defective earth electrode & faulty/damaged earthling conductors<br>**P13.** Test installed electrical equipment for safe and optimum performance according to standards & regulations<br>**P14.** Record the results of the test performed on a standard format |
| CU2. Carry out Preventive Maintenance | **P1.** Perform Preventive maintenance as specified by the manufacturers or SOP<br>**P2.** Check out the equipment logging sheet and updates logging<br>**P3.** Update Maintenance/service records as per requirement |

**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:

- Interpretation of layout diagrams, technical sketches, graphic symbols and wiring diagrams, and manufacturer's specifications etc.
- Describe types of electrical tools used for troubleshooting and preventive maintenance purposes
- Describe types of electrical measuring
- Describe instruments used in testing electrical installations
- Describe types of electrical wiring systems for domestic& industrial purposes
- Describe methods of tracing the fault
- Describe types of electrical control and protective switchgear and accessories used in electrical circuits
- Describe types and principles of operation of circuit breakers used in electrical installations and their applications
- Describe types of electrical wires and cables and their ratings
- Describe types of electrical accessories and their application on electrical installations

- Describe types of earthling systems used in domestic& industrial electrical installations
- Describe Importance of testing electrical installations Importance of corrective & preventive maintenance

**Critical Evidence(s) Required**

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

- Perform fault identification and take corrective action
- Carry out the preventive maintenance
- Perform service/repair record keeping

**Tools and Equipment**

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

| S. No. | Items |
|---|---|
| 1. | Specific Gravity Chart |
| 2. | Splicing Machine |
| 3. | Spring tension checking meter |
| 4. | Tachometer |
| 5. | Soldering Lead |
| 6. | Soldering Iron |
| 7. | Set of Screw Drivers |
| 8. | Set of Nose Pliers |
| 9. | Safety Shoes |
| 10. | Ring Spanner Set |
| 11. | RPM Meter |
| 12. | Safety Helm |
| 13. | Safety Goggles |
| 14. | Safety Belt |
| 15. | IR Temperature Gun |
| 16. | Mini Hydraulic Press Machine |
| 17. | OTDR Mete |
| 18. | Multimeter |
| 19. | Overall Combination |
| 20. | Phase Sequence Meter |
| 21. | Philips Screw drivers Set |
| 22. | L Scale |
| 23. | Lux Meter |
| 24. | Lugs Punching Machine (Hydraulic and Manual) |
| 25. | Medgar (Insulation Tester) |
| 26. | Micron Meter |
| 27. | Magnetic Conductor |
| 28. | Ammeter |

29. Hydrometer
30. Hole saw
31. Handsaw
32. Hammer
33. Hacksaw
34. Grinder
35. Battery Charger
36. Gloves
37. Generator
38. Flux
39. Filler gauge
40. Files (set)
41. Earth Tester
42. Battery Cleaning Ki
43. Duct Rod
44. Disk Grinder
45. Combination Plier Set
46. Clamp Meter
47. Circuit Boards
48. Bearing Puller
49. Bench Vice
50. Chisel
51. Cells tester
52. Cable Knife
53. Cable / Wire Gauge

## 0714E&A15. Carry Out Electrical Planning and Estimation

**Overview**: This competency standard covers the skills and knowledge required to analyse customer requirement and specification, Plan and estimate domestic electric work, Plan and estimate commercial electric work and Plan and estimate industrial electric work.

| Competency Unit | Performance Criteria |
|---|---|
| CU1. Analyze customer requirement and specification | **P1.** Draw the general value chain of the end user.<br>**P2.** Highlight the various stages and set of activities in the value chain drawing<br>**P3.** Enlist the electrical appliances/materials required in electrical development process<br>**P4.** Identify critical stages in the development<br>**P5.** Identify the safety aspect required in the critical stages of the development<br>**P6.** Enlist the possible energy efficient appliance/devices and global trends in electrical works<br>**P7.** Analyse the client requirement at broad level.<br>**P8.** Generate a report of various stages of electrical works.<br>**P9.** Proposed appliance/materials as per global trends and clarify the technical specification. |
| CU2. Plan and estimate domestic electric work | **P1.** Plan the client requirement at broad level from the proposal.<br>**P2.** Plan the electrical appliances/materials / used in different stages of the electrical development process<br>**P3.** Plan and estimate electrical wiring<br>**P4.** Estimate Installation and Material Cost<br>**P5.** Estimate Power consumption for lighting and appliances<br>**P6.** Plan a main and sub distribution board.<br>**P7.** Ensure safety system. |
| CU3. Plan and estimate commercial electric work. | **P1.** Analyse the client requirement at broad level from the proposal.<br>**P2.** Plan the electrical equipment /appliances/materials / used in different stages of the commercial electrical work<br>**P3.** Plan and estimate electrical wiring<br>**P4.** Estimate Installation and Material Cost<br>**P5.** Estimate Power consumption for centralize lighting, heating, cooling system and other appliances.<br>**P6.** Plan a main and sub distribution board.<br>**P7.** Ensure safety measures in development process.<br>**P8.** Enlist the material required. |
| CU4. Plan and estimate | **P1.** Analyse the client requirement at broad level from the |

| | |
|---|---|
| industrial electric work. | proposal.<br>**P2.** Plan the electrical equipment /appliances/materials / used in different stages of the commercial electrical work<br>**P3.** Plan and estimate electrical wiring<br>**P4.** Estimate Installation and Material Cost<br>**P5.** Estimate Power consumption for centralize lighting, heating, cooling system and other appliances.<br>**P6.** Plan 3-phase line for heavy loads<br>**P7.** Plan a separate control panel box for heavy machinery.<br>**P8.**<br>**P9.** Plan a main and sub distribution board.<br>**P10.** Design a safety system for protection of machinery and labour.<br>**P11.** Assign colour scheme for safety measures |

**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:

- Define the term 'value chain' of industry.
- Define human machine interface (HMI)
- Define the Standard operating procedure (SOP) of the organization for control panel development process.
- Describe how to prepare a General arrangement drawing
- Define IEC standards
- Describes the standard of electrical components.
- Describes equipment properties.
- Describe the rules and regulation of work.
- Define Electrical Specifications component used.
- Describes the input and output of tool of electronic.

**Critical Evidence(s) Required**

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

- Analyze customer requirement and specification
- Perform planning and estimation of domestic/commercial and industrial electric work.

**Tools and Equipment**

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

S. No. Items

1. Reference Material
2. Clipboard
3. Calculation Sheet
4. Calculator
5. Psychometric Charts and Tables
6. Protective gear such as helmets, goggles, gloves, rubber shoes, etc.

***Digital Skills***

**0714E&A16. Install computer operating systems and hardware**

**Overview:** This unit describes the performance outcomes, skills and knowledge required to select, configure and use computer operating systems and basic computer hardware.

| Unit of Competency | **Performance Criteria** |
|---|---|
| **CU1. Identify operating system and hardware components** | **P1.** Determine ICT organizational requirements and specifications<br>**P2.** Identify and select the operating system<br>**P3.** Identify appropriate external hardware components<br>**P4.** Identify internal hardware components |
| **CU2. Install and configure operating system and application software with hardware components** | **P1.** Install and configure operating system to meet organizational requirements<br>**P2.** Identify the functions associated with the operating system and associated boot process<br>**P3.** Configure power-management settings to minimize power consumption as an environmentally sustainable measure<br>**P4.** Use both the graphical user interface and the command line interface to perform basic tasks<br>**P5.** Install or upgrade application software onto the operating system and hardware configuration ?? no need<br>**P6.** Determine the relationship between an application program, the operating system and hardware<br>**P7.** Identify general differences between the different computer platforms and their respective operating systems |
| **CU3. Optimize operating system and hardware components** | **P1.** Optimize operating system using included tools or third-party utilities<br>**P2.** Customize the graphical user interface<br>**P3.** Use techniques unique to the command line interface<br>**P4.** Set up and configure external hardware components and check functionality<br>**P5.** Install drivers as appropriate and check functionality |

**Knowledge & Understanding**

K1: Basic knowledge of current industry-accepted operating system, hardware and software products

K2: Compatibility of an operating system, in respect to other versions

K3: Function of single-user and multi-user operating systems

K4: Interoperability between operating systems

K5: OHS principles and responsibilities, including ergonomic principles to avoid injury associated with using computer systems.

**Critical Evidence(s) Required**

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

A person who demonstrates competency in this unit must be able to provide evidence of the ability to select, configure and use computer operating systems and basic computer hardware. The evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

**Performance requirements**

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Demonstrated evidence is required of the ability to:

- Use an operating system in a variety of scenarios and across functions, including:
    - scheduling, loading, initiating, and supervising the execution of programs
    - allocating storage
    - initiating and controlling input and output operations
    - handling errors
- Identify and install suitable hardware components
- Install and upgrade application software.

## 0714E&A17. Operate digital media technology

**Overview:** This unit describes the performance outcomes, skills and knowledge required to identify, select and use a digital media package and supporting technologies.

| Unit of Competency | Performance Criteria |
|---|---|
| **CU1. Use appropriate OHS office work practices** | **P1.** Use safe work practices to ensure ergonomic, ??? work organization, energy and resource conservation requirements are addressed<br>**P2.** Use wrist rests and document holders where appropriate<br>**P3.** Use monitor anti-glare and radiation reduction screens where appropriate |
| **CU2. Identify and select appropriate digital media package** | **P1.** Identify the basic requirements of a design brief, including user environment<br>**P2.** Research and review suitable available digital media packages<br>**P3.** Select an appropriate digital media package to meet design brief requirements |
| **CU3. Use digital media package** | **P1.** Procure or create suitable data to meet requirements of the brief<br>**P2.** Manipulate data using digital media package tools<br>**P3.** Ensure naming and storing of documents in appropriate file format in directories or folders |
| **CU4. Review digital media design** | **P1.** Evaluate design for creative, dramatic and technical quality, file size, and suitability to meet the brief<br>**P2.** Test and run any incorporated graphics, video or sound as part of a digital media presentation and present designs in the appropriate format<br>**P3.** Review final product against the design |

**Knowledge & Understanding**

K1: Basic principles of visual design

K2: Functions and features of digital media packages and technologies

K3: Graphic design and stylistic language conventions

K4: OHS principles and responsibilities for ergonomics, such as work periods and breaks

K5: Principles of digital imaging and file formats, video and sound file formats, file management and transfer systems

K6: Vendor product directions in digital media hardware and software

K7: Visualization and interpreting creative information, scripts (text) and images

**Critical Evidence(s) Required**

A person who demonstrates competency in this unit must be able to provide evidence of the ability to identify, select and use a digital media package and supporting technologies. The evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

**Performance requirements**

This competency is to be assessed using standard and authorised work practices, safety requirements and environmental constraints. Demonstrated evidence of the ability to:

- Identify basic requirements of a design brief
- Use digital media package to meet organizational requirements
- Use OHS principles and responsibilities for ergonomics, such as work periods and breaks
- Use help manuals and online help when appropriate
- Use digital media technologies to support design brief requirements.

## 0714E&A18. Perform computer operations

**Overview:** This unit covers the knowledge, skills and attitudes and values needed to perform computer operations which include inputting, accessing, producing and transferring data using the appropriate hardware and software.

| Unit of Competency | Performance Criteria |
|---|---|
| **CU1. Plan and prepare for task to be undertaken** | **P1.** Requirements of task are determined as per standard Start with action word !!!<br>**P2.** operating the procedures<br>**P3.** Appropriate hardware and software is selected according to task assigned and required outcome<br>**P4.** Task is planned to ensure |
| **CU2. Input data into computer** | **P5.** Data are entered into the computer using appropriate Start with action word !!!<br>**P1.** program/application in accordance with company procedures<br>**P2.** Accuracy of information is checked and information is saved in accordance with standard operating procedures<br>**P3.** Inputted data are stored in storage media according to requirements<br>**P4.** Work is performed within ergonomic guidelines |
| **CU3. Access information using computer** | **P1.** Correct program/application is selected based on job requirements<br>**P2.** Program/application containing the information required is accessed according to company procedures<br>**P3.** Desktop icons are correctly selected, opened and<br>**P4.** closed for navigation purposes<br>**P5.** Keyboard techniques are carried out in line with OH & S requirements for safe use of keyboards |
| **CU4. Produce/output data using computer system** | **P1.** Entered data are processed using appropriate software commands<br>**P2.** Data are printed out as required using computer hardware/peripheral devices in accordance with standard operating procedures<br>**P3.** Files and data are transferred between compatible<br>**P4.** systems using computer software, hardware/ eripheral<br>**P5.** devices in accordance with standard operating<br>**P6.** Procedures ?? Start with action word !!!<br>**P6.** |
| **CU5. Maintain computer equipment and systems** | **P1.** Systems for cleaning, minor maintenance and replacement of consumables are implemented correct as above |

| | |
|---|---|
| | **P2.** Procedures for ensuring security of data, including regular back-ups and virus checks are implemented in accordance with standard operating procedures<br>**P3.** Basic file maintenance procedures are implemented in line with the standard operating procedures |

**Knowledge & Understanding**

K1: Basic ergonomics of keyboard and computer use

K2: Main types of computers and basic features of different operating systems

K3: Main parts of a computer

K4: Storage devices and basic categories of memory

K5: Relevant types of software

K6: General security

K7: Viruses

K8: OH & S principles and responsibilities

K9: Calculating computer capacity

**Critical Evidence(s) Required**

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

**Performance requirements**

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Demonstrated evidence is required of the ability to:

- Selected and used hardware components correctly and according to the task requirement
- Identified and explain the functions of both hardware and software used, their general features and capabilities
- Produced accurate and complete data in accordance with the requirements
- Used appropriate devices and procedures to transfer files/data accurately
- Maintained computer system

## 0714E&A19. Use computer applications

**Overview:** This unit describes the performance outcomes, skills and knowledge required to identify, select and operate three commercial software packages, including a word-processing, a spreadsheet and presentation application package.

| Unit of Competency | **Performance Criteria** |
|---|---|
| **1. Use appropriate OHS office work practices** | 1.1 Use safe work practices to ensure ergonomic work ?? not clear organization, energy and resource conservation requirements are addressed<br>1.2 Use appropriate wrist rests and document holders<br>1.3 Use monitor anti-glare and radiation reduction screens where appropriate |
| **2. Install and remove software** | 2.1 Select software to be installed<br>2.2 Follow installation instructions<br>2.3 Delete unwanted software |
| **3. Use appropriate word-processing software** | 3.1 Select word-processing software appropriate to perform activity<br>3.2 Identify document purpose, audience and presentation requirements, and clarify with the concern personnel<br>3.3 Identify organizational requirements for text-based business documents and design document structure and layout to ensure consistency of style and image<br>3.4 Match document requirements with software functions to provide efficient production of documents<br>3.5 Use technical functions, other data and formatting to finalize documents<br>3.6 Ensure the naming and storing of documents in appropriate directories or folders and the printing of documents to the required specifications |
| **4. Use appropriate spreadsheet software** | 4.1 Select spreadsheet software appropriate to perform activity<br>4.2 Identify document purpose, audience and presentation requirements, and clarify with personnel as required<br>4.3 Enter simple formulas and functions using cell referencing where required<br>4.4 Customize spreadsheet settings and format documents to meet requirements<br>4.5 Ensure the naming and storing of documents in appropriate |

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|---|---|
| | directories or folders and the printing of documents to the required specifications |
| **5. Use appropriate presentation software** | 5.1 Select software application package appropriate to perform activity<br>5.2 Identify purpose, audience and presentation requirements, and clarify with personnel as required<br>5.3 Use technical functions, other data and formatting to finalize documents<br>5.4 Ensure documents are named and stored in appropriate directories or folders and printed to required specifications<br>5.5 Make a presentation |

**Knowledge & Understanding**

K1: Application software packages used by the organization
K2: Basic technical terminology related to reading help files and responding to system help prompts
K3: Basic knowledge of system usage
K4: Current business practices related to using software to prepare reports
K5: Features and functions of commercial computing packages
K6: Import and export software functions
K7: Linking documents
K8: OHS principles and responsibilities for ergonomics, such as work periods and breaks
K9: Purpose, use and functions of applications
K10: Use of input and output devices
K11: Functions and uses of word processing, spreadsheet and presentation software

**Critical Evidence(s) Required**

A person who demonstrates competency in this unit must be able to provide evidence of the ability to identify, select and operate three commercial software packages, including a word-processing and a spreadsheet application package. The evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

**Performance requirements**

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Evidence of the ability to:

- Produce workplace documents using a minimum of three different software application packages
- Open, amend and save files and documents according to organizational requirements
- Use OHS principles and responsibilities for ergonomics, such as work periods and breaks
- Use help manuals and online help.

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Demonstrated evidence is required of the ability to:

- Use an operating system in a variety of scenarios and across functions, including:
    - scheduling, loading, initiating, and supervising the execution of programs
    - allocating storage
    - initiating and controlling input and output operations
    - handling errors
- Identify and install suitable hardware components
- Install and upgrade application software.

## 0714E&A20. Create user documentation

**Overview:** This unit describes the performance outcomes, skills and knowledge required to create user documentation that is clear to the target audience and easy to navigate.

| Unit of Competency | **Performance Criteria** |
|---|---|
| **1. Determine documentation standards and requirements** | 1.1 Determine documentation requirements<br>1.2 Investigate documentation and industry standards for requirements and determine appropriate application to user documentation<br>1.3 Design documentation templates using appropriate software and obtain approval from appropriate person |
| **2. Produce user documentation** | 2.1 Conduct a review of the subject system, program, network or application in order to understand its functionality<br>2.2 Gather existing technical, design or user specifications and supporting documentation<br>2.3 Create user documentation based on template to record the operation of the subject system, program, network or application |
| **3. Review and obtain sign-off** | 3.1 Submit user documentation to target audience for review<br>3.2 Gather and analyze feedback<br>3.3 Make changes to user documentation<br>3.4 Submit user documentation to appropriate person for approval |

**Knowledge & Understanding**

K1: Content features, including clarity and readability

K2: Document design, web design and usability

K3: Functions and features of templates and style guides

K4: Instructional design principles

**Critical Evidence(s) Required**

A person who demonstrates competency in this unit must be able to provide evidence of the ability to create user documentation that is clear to the target audience and easy to navigate. The evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

**Performance requirements**

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Demonstrated evidence is required of the ability to create user documentation that:

- Meets business requirements
- Caters for a diverse readership
- Is clear to the target audience
- Is easy to navigate.

## 0714E&A21. Create technical documentation

**Overview:** This unit describes the performance outcomes, skills and knowledge required to create technical documentation that is clear to the target audience and easy to navigate.

| Unit of Competency | **Performance Criteria** |
|---|---|
| **1. Identify and analyze documentation requirements and client needs** | 1.1 Consult with client to identify documentation requirements<br>1.2 Interpret and evaluate documentation requirements and confirm details with client<br>1.3 Investigate industry and documentation standards for requirements<br>1.4 Define and document the scope of work to be produced<br>1.5 Consult with client to validate and confirm the scope of work |
| **2. Design documentation** | 2.1 Identify information requirements with reference to layout and document structure<br>2.2 Create document templates and style guides consistent with information requirements<br>2.3 Conduct a review of the system in order to understand its functionality<br>2.4 Extract content that meets information requirements according to copyright restrictions<br>2.5 Develop the structure of the technical documentation giving focus to the flow of information, style, tone and content format<br>2.6 Validate the technical documentation structure with the client |
| **3. Develop documentation** | 3.1 Write technical documentation based on the template and scope of work using the information gathered<br>3.2 Translate technical terminology into simple / plain English where appropriate<br>3.3 Apply content format and style according to documentation standards and templates |
| **4. Evaluate and edit documentation** | 4.1 Submit technical documentation to appropriate person for review<br>4.2 Gather and analyze feedback<br>4.3 Incorporate alterations into the technical documentation<br>4.4 Edit the technical documentation for technical and grammatical errors. |
| **5. Prepare documentation for publication** | 5.1 Check that the completed technical documentation meets client requirements and scope of work<br>5.2 Submit the technical documentation to appropriate person for approval correct as previous |

| | |
|---|---|
| | 5.3 Prepare the technical documentation for publication and distribution using appropriate channels |

**Knowledge & Understanding**

K1: Content features, such as clarity and readability

K2: Document design, web design and usability

K3: Functions and features of templates and style guides

K4: Instructional design principles

K5: Organizational policies, procedures and standards that cover document design.

**Critical Evidence(s) Required**

A person who demonstrates competency in this unit must be able to provide evidence of the ability to create technical documentation that is clear to the target audience and easy to navigate. The evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

**Performance requirements**

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Demonstrated evidence is required of the ability to:

- Establish customer needs
- Design and develop technical documentation, such as system, procedures, training material and user guides, incorporating appropriate standards
- Update document with client feedback
- Prepare documentation for publication.

## 0714E&A22. Create basic databases

**Overview:** This unit describes the skills and knowledge required to design, develop and test a database in order to meet a specification. It applies to individuals who may be either database, or web designers, required to create a simple database to store information for an online application, using a simple entity relational database.

| Unit of Competency | **Performance Criteria** |
|---|---|
| **1. Analyze the requirements for the database** | 1.1 Determine the information that the database is required to hold<br>1.2 Develop a written requirement report for the functionality of the database<br>1.3 Complete the documentation, and submit it to an appropriate person in order to be approved |
| **2. Use data modeling to design the database to suit requirements** | 2.1 Design an entity-relationship (ER) diagram to model the relationships between the entities and the attributes that the database will hold<br>2.2 Develop primary and foreign keys to link the entities<br>2.3 Develop a data dictionary<br>2.4 Complete the documentation, and submit it to the appropriate person for approval correct as above |
| **3. Create a database on a web or database server** | 3.1 Use the appropriate language on a web or database server to create few databases<br>3.2 Use the appropriate language on a web or database server to create few tables<br>3.3 Populate the database fields |
| **4. Test the database and debug** | 4.1 Test the database on the web or a database server<br>4.2 Ensure that the information represented matches the requirements |

**Knowledge & Understanding**

K1: outline the principles of open platforms, including browsers and databases

K2: list the processes associated with the creation of entities, attributes, and I populating fields, using both software solutions and script- based input

K3: describe data-modeling techniques to design a database

K4: outline the steps in database design, modeling and implementation

K5: describe the internet operation related to web servers and clients

K6: identify the naming conventions appropriate to database design

K7: identify security restrictions on servers, incorporating some theoretical concepts

K8: describe best practice communication, and accessibility, for audiences with special needs.

**Critical Evidence(s) Required**

A person who demonstrates competency in this unit must be able to provide evidence of the ability to create technical documentation that is clear to the target audience and easy to navigate. The evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

**Performance requirements**

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Demonstrated evidence is required of the ability to:

- research client requirements for a database solution
- design a database that meets client requirements
- create a database on a web hosting service or server to meet client requirements by a due date
- Test and debug the database.

## 0714E&A23. Use social media tools for collaboration and engagement

**Overview:** This unit describes the performance outcomes, skills and knowledge required to establish a social networking presence using social media tools and applications. The unit specifically identifies the requirement to review, compare and use different types of social networking tools and applications.

| Unit of Competency | **Performance Criteria** |
|---|---|
| **1. Describe different types of social media tools and applications** | 1.1 Explain characteristics of the term social media<br>1.2 Identify different types of social-media tools and applications<br>1.3 Illustrate various issues associated with the use of social media tools and applications |
| **2. Compare different types of social media tools and applications** | 2.1 Select one social media type for review<br>2.2 Review most popular tools and applications within that social media<br>2.3 Itemize benefits across a range of the most popular tools and applications<br>2.4 Select most appropriate social media tool or application |
| **3. Set up and use popular social media tools and applications** | 3.1 Identify social media tools and applications for possible implementation<br>3.2 Initiate preferred social media tools and applications ??<br>3.3 Establish social media interface using text and file content<br>3.4 Initiate social network interaction<br>3.5 Test and evaluate tools and applications for ease of use<br>3.6 Report and elaborate the findings |

**Knowledge & Understanding**

K1: Basic technical terminology in relation to social networking and social media applications and tools

K2: Basic knowledge of uploading images, text files, pdf files, audio files, video files and link associated files

K3: Features and functions of social media applications

K4: Import and export software functions

K5: Linking documents

K6: OHS principles and responsibilities for ergonomics, including work periods and breaks

K7: Tagging to facilitate collaborative folksonomy

K8: Social media applications and procedures for connecting to social networking sites

K9: Use of input and output devices

K10: Use of RSS feeds to connect a social network.

**Critical Evidence(s) Required**

A person who demonstrates competency in this unit must be able to provide evidence of the ability to create technical documentation that is clear to the target audience and easy to navigate. The evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

**Performance requirements**

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Demonstrated evidence is required of the ability to:

- Establish customer needs
- Design and develop technical documentation, such as system, procedures, training material and user guides, incorporating appropriate standards
- Update document with client feedback
- Prepare documentation for publication.

## 0714E&A24. E-Commerce- SEO (Search Engine Optimization)

**Overview:** The aim of this module is to develop efficient E-Marketing strategies in accordance with the Vision and Mission statement of the organization driven by Electronic means.

| Unit of Competency | **Performance Criteria** |
|---|---|
| **1. SEO (Search Engine Optimization)** | 1.1 Apply various SEO techniques<br>1.2 Employ several SEO key words<br>1.3 Demonstrate SEO techniques to priorities their site or web application using automated tools |

**Knowledge & Understanding**

K1: Explain different SEO Methods including but not limited to Getting Indexed, Preventing Crawling, and Increasing Prominence.

K2: Elaborate White-hat, Black-hat SEO techniques for web application

K3: Knowledge of SEO key words for web pages translation.

K4: Application of SEO tools usage

**Critical Evidence(s) Required**

A person who demonstrates competency in this unit must be able to provide evidence of the ability to write and edit copy that is clear to the target audience and easy to navigate. The evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

**Performance requirements**

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Demonstrated evidence is required of the ability to:

## 0714E&A25. E-Commerce- SCM (Supply Chain Management)

**Overview:** The aim of this module is to develop efficient E-Marketing strategies in accordance with the Vision and Mission statement of the organization driven by Electronic means.

| Unit of Competency | **Performance Criteria** |
|---|---|
| **1. SCM (Supply Chain Management)** | 1.1 Identity and connect with various potential Suppliers<br>1.2 Connect and Evaluate their market status and reputation<br>1.3. Select / short list an appropriate supplier<br>1.3 Place order as per requirement /inventory<br>1.4 Inspect received order<br>1.5 Maintain Inventory as per Inventory Control / store keeping techniques<br>1.6 Identity the various different available transportation mode<br>1.7 Identify steps of reverse SCM i-e from consumer to organization |

**Knowledge & Understanding**

K1: Elaborate knowledge of procurement Cycle (Launch of RFP/RFQ, Tender, Bidding, Comparative Statement, Award of Contract, Maintenance)

K2: Explain different techniques to manage

K3: Explain product delivery and their traceability

K4: Knowledge of Incorporation of Outsourcing in logistics.

K5: Information about electronic Data Interchange methodologies and format

**Critical Evidence(s) Required**

A person who demonstrates competency in this unit must be able to provide evidence of the ability to write and edit copy that is clear to the target audience and easy to navigate. The evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

**Performance requirements**

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Demonstrated evidence is required of the ability to:

## 0714E&A26. E-Commerce- Social Media Marketing

**Overview:** The aim of this module is to develop efficient E-Marketing strategies in accordance with the Vision and Mission statement of the organization driven by Electronic means.

| Unit of Competency | **Performance Criteria** |
|---|---|
| **1. Social Media Marketing** | 1.1 Identify various Social media marketing techniques<br>1.2 Apply suitable Classified Advertisement techniques on social media<br>1.3 Perform Electronic Mail Marketing<br>1.4 Creation of Blogs |

**Knowledge & Understanding**

K1: Describe Knowledge of different social media sites that is Facebook, Twitter, LinkedIn, Google+ etc., Comparative Statement, Award of Contract, Maintenance)
K2: Explain Brand pages creation on social media sites.
K3: Evaluate familiarity of banner ads integration on different web sites like newspaper site in any demographic region.
K4: Mention skills to regularly update brand/product/service blogs.K5: Information about electronic Data Interchange methodologies and format
K5: Elaborate direct marketing techniques e.g. Email, SMS (Mobile- Commerce) for the projection of company newsletters

**Critical Evidence(s) Required**

A person who demonstrates competency in this unit must be able to provide evidence of the ability to implement e-marketing strategies that is clear to the target audience and easy to navigate. The evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

**Performance requirements**

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Demonstrated evidence is required of the ability to:

## 0714E&A27. Use digital devices

**Overview:** This unit describes the skills and knowledge required to use a range of digital devices, such as a digital camera, video camera, or personal digital assistant (PDA) device. It applies to individuals who require entry level information and communications technology (ICT) knowledge and literacy skills to support their work in a home office or small office environment.

| Unit of Competency | **Performance Criteria** |
|---|---|
| **1. Prepare to use the digital device** | 1.1 Review and identifiy the instruction manual and ensure components are available<br>1.2 Identify the physical components of the digital device<br>1.3 Turn on and follow access procedures to activate the digital device<br>1.4 Alter the digital device settings to best suit intended ?? use<br>1.5 Configure power management settings where appropriate to minimize power consumption, as an environmentally sustainable measure |
| **2. Set up and use the digital device** | 2.1 Identify and set the basic operating, security and menu settings<br>2.2 Navigate and manipulate the screen environment<br>2.3 Customize screen icons and access to applications where applicable<br>2.4 Use the digital device, save and edit the output where applicable<br>2.5 Identify more advanced features available and use as required |
| **3. Access and use basic connectivity devices** | 3.1 Connect to external digital devices, such as computer devices or storage devices, to retrieve, copy, move and save information<br>3.2 Check physical connectivity of computer devices or storage devices to ensure operation and performance<br>3.3 Connect to a printer either through a computer device or directly, and use printer settings and print data<br>3.4 Access audio-visual devices to view and play a multimedia file |
| **4. Shut down digital device** | 4.1 Save current work and back up important data<br>4.2 Close open programs on the digital device and any computer device or storage device<br>4.3 Shut down digital devices, according to manufacturer instructions |

**Knowledge & Understanding**

K1: outline the capabilities and connectivity requirements of relevant:

- audio-visual devices

- peripheral devices
- storage devices

K2: list basic security functions

K3: explain basic software operation and associated applications

K4: explain digital device functions

K5: explain digital device settings.

**Critical Evidence(s) Required**

A person who demonstrates competency in this unit must be able to provide evidence of the ability to use digital devices that is clear to the target audience and easy to navigate. The evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

**Performance requirements**

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Demonstrated evidence is required of the ability to:

- turn on a digital device
- use the menu features and navigate a graphical user interface
- use device features to perform tasks
- Save the results of work.

## 0714E&A28. Operate word-processing applications

**Overview:** This unit describes the skills and knowledge required to operate word-processing applications and perform basic operations, including creating and formatting documents, creating tables and printing labels. It applies to individuals in the workplace using fundamental knowledge of word-processing under direct supervision or with limited responsibility.

| Unit of Competency | **Performance Criteria** |
|---|---|
| **1. Apply workplace health and safety (WHS) practices** | 1.1 Use workplace ergonomic work practices and strategies<br>1.2 Organize work area to ensure an ergonomic work environment |
| **2. Create documents** | 2.1 Open word-processing application, create document and add data according to information requirements<br>2.2 Use document templates as required<br>2.3 Use simple formatting tools when creating the document<br>2.4 Save document to directory |
| **3. Customize basic settings to meet page layout conventions** | 3.1 Adjust page layout to meet information requirements<br>3.2 Open and view various toolbars<br>3.3 Change font format to suit document purpose<br>3.4 Change alignment and line spacing according to document information requirements<br>3.5 Modify margins to suit the document purpose<br>3.6 Open and switch between several documents |
| **4. Format documents** | 4.1 Use formatting features and styles as per required<br>4.2 Highlight and copy text from another area in the document or from another active document<br>4.3 Insert headers and footers to incorporate necessary data<br>4.4 Save document in another file format<br>4.5 Save and close document to a storage device |
| **5. Create tables** | 5.1 Insert standard table into document<br>5.2 Change the cells to meet the required information<br>5.3 Insert and delete columns and rows as necessary<br>5.4 Use formatting tools according to the style of requirements |
| **6. Add images** | 6.1 Insert appropriate images into document and customize as necessary<br>6.2 Position and resize images to meet document formatting needs |
| **7. Print documents** | 7.1 Preview the document in print preview mode<br>7.2 Select basic print settings |

## 7.3 Print document or part of document from printer

**Knowledge & Understanding**

K1: describe formatting styles and their effect on formatting, readability and appearance of documents
K2: identify organizational requirements for ergonomics, including work periods and breaks
K3: select organizational style guide to use
K4: outline purpose, use and function of word-processing software.

**Critical Evidence(s) Required**

A person who demonstrates competency in this unit must be able to provide evidence of the ability to create word documents that is clear to the target audience and easy to navigate. The evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

**Performance requirements**

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Demonstrated evidence is required of the ability to:

- follow organizational ergonomic work health and safety (WHS) requirements and practices
- create, open and retrieve documents using customized basic settings
- format documents by creating tables and adding text, objects and images
- Save and prints documents.

## 0714E&A29. Operate spreadsheet applications

**Overview:** This unit describes the skills and knowledge required to operate word-processing applications and perform basic operations, including creating and formatting documents, creating tables and printing labels. It applies to individuals in the workplace using fundamental knowledge of word-processing under direct supervision or with limited responsibility.

| Unit of Competency | **Performance Criteria** |
|---|---|
| **1. Create presentations** | 1.1 Open presentation package and create a simple design for a presentation according to organizational requirements<br>1.2 Open the blank presentation and add text and graphics<br>1.3 Apply existing styles within a presentation<br>1.4 Use presentation template and slides to create a presentation<br>1.5 Use various tools to improve the look of the presentation<br>1.6 Save presentation to the appropriate storage device and folder |
| **2. Customize basic settings** | 2.1 Adjust display to meet user requirements<br>2.2 Open and view different toolbars to view options<br>2.3 Ensure font settings are appropriate for the presentation purpose<br>2.4 View multiple slides at once |
| **3. Format presentations** | 3.1 Use and incorporate organizational charts and bulleted lists, and modify as required<br>3.2 Add objects and manipulate to meet presentation purposes<br>3.3 Import objects and modify for presentation purposes<br>3.4 Modify slide layout, including text and colors, to meet presentation requirements<br>3.5 Use formatting tools as required within the presentation<br>3.6 Duplicate slides within and across a presentation<br>3.7 Reorder sequence of slides and delete slides for presentation purposes<br>3.8 Save presentation in another format<br>3.9 Save to storage device and close presentation |
| **4. Add slide show effects** | 4.1 Incorporate pre-set animation and multimedia effects into presentation as required to enhance the presentation<br>4.2 Add slide transition effects to presentation to ensure smooth progression through the presentation<br>4.3 Test presentation for overall effect |

| | |
|---|---|
| | 4.4 Use onscreen navigation tools to start and stop slide show or move between different slides as required |
| **5. Print presentation and notes** | 5.1 Select appropriate print format for presentation<br>5.2 Select preferred slide orientation<br>5.3 Add notes and slide numbers<br>5.4 Preview slides and run spell check before presentation<br>5.5 Print selected slides and submit presentation to appropriate person for feedback |

**Knowledge & Understanding**

K1: list basic technical terminology to read help files and prompts

K2: outline the different types of:

- formal and informal presentations
- audience

K3: explain the effect of design and formatting on the readability and usability of presentations

K4: outline presentation pitfalls

K5: identify suitable presentation effects for different audiences.

**Critical Evidence(s) Required**

A person who demonstrates competency in this unit must be able to provide evidence of the ability to presentations that is clear to the target audience and easy to navigate. The evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

**Performance requirements**

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Demonstrated evidence is required of the ability to:

- create, format and prepare presentations for distribution and display
- customize basic settings
- Add slide show effects.

## 0714E&A30. Operate presentation packages

**Overview:** This unit describes the skills and knowledge required to operate word-processing applications and perform basic operations, including creating and formatting documents, creating tables and printing labels. It applies to individuals in the workplace using fundamental knowledge of word-processing under direct supervision or with limited responsibility.

| Unit of Competency | **Performance Criteria** |
|---|---|
| **1. Create spreadsheets** | 1.1 Open the spreadsheet application, create spreadsheet files and enter numbers, text and symbols into cells according to information requirements<br>1.2 Enter simple formulae and functions using cell referencing when required<br>1.3 Correct formulae when error messages occur<br>1.4 Use a range of common tools during spreadsheet development<br>1.5 Edit columns and rows within the spreadsheet<br>1.6 Use the auto-fill function to increment data where required<br>1.7 Save the spreadsheet to a folder on a storage device |
| **2. Customize basic settings** | 2.1 Adjust page layout to meet user requirements or special needs<br>2.2 Open and view different tool bars<br>2.3 Change font settings so they are appropriate for the document purpose<br>2.4 Change alignment options and line spacing according to spreadsheet formatting features<br>2.5 Format cell to display different styles as required<br>2.6 Modify margin sizes to suit the purpose of the spreadsheets<br>2.7 View multiple spreadsheets concurrently |
| **3. Format spreadsheet** | 3.1 Use formatting features as required<br>3.2 Copy selected formatting features from another cell in the spreadsheet or from another active spreadsheet<br>3.3 Use formatting tools as required within the spreadsheet<br>3.4 Align information in a selected cell as required<br>3.5 Insert headers and footers using formatting features<br>3.6 Save spreadsheet as another file type<br>3.7 Save to storage device and close the spreadsheet |
| **4. Incorporate object and chart in spreadsheet** | 4.1 Import an object into an active spreadsheet |

| | |
|---|---|
| | 4.2 Manipulate the imported object by using formatting features<br>4.3 Create a chart using selected data in the spreadsheet<br>4.4 Display selected data in a different chart<br>4.5 Modify chart using formatting features |
| **5. Print spreadsheet** | 5.1 Preview spreadsheet in print preview mode<br>5.2 Select basic printer options<br>5.3 Print spreadsheet or selected part of spreadsheet<br>5.4 Submit the spreadsheet to appropriate person for approval or feedback |

**Knowledge & Understanding**

K1: list basic technical terminology related to reading help files and prompts

K2: explain the effect of formatting and appearance on the readability and usability of spreadsheets

K3: outline log-in procedures relating to accessing a personal computer (PC)

K4: describe the purpose, use and function of spreadsheet applications

**Critical Evidence(s) Required**

A person who demonstrates competency in this unit must be able to provide evidence of the ability to create technical documentation that is clear to the target audience and easy to navigate. The evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

**Performance requirements**

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Demonstrated evidence is required of the ability to:

- create spreadsheets
- customize basic settings
- format spreadsheets
- create basic formulas
- insert objects and charts in spreadsheets
- Save and print spreadsheets.

## 0714E&A31. Perform writing and editing tasks

**Overview:** This unit describes the skills and knowledge required to apply the conventions of plain English to writing and editing tasks of different forms. It also includes editing and proofreading techniques. It applies to individuals in various writing contexts who write and edit texts using appropriate language, style, grammar, spelling, and standard conventions for editing and proofreading.

| Unit of Competency | **Performance Criteria** |
|---|---|
| **1. Apply clear and appropriate language and style to writing and editing tasks** | 1.1 Use safe work practices including addressing ergonomic requirements when undertaking writing tasks<br>1.2 Use clear, concise and plain English in writing and editing tasks<br>1.3. Write / Use the active form in the sentences and avoid the Passive and Indirect form in the sentences in order to avoid ambiguities.<br>1.3 Use / Apply the appropriate connecting words and paragraph's structures in the written materials to ensure the clarity, ease and reading comprehension<br>1.4 Make a clear and logical connections between sentences, paragraphs and sections with the follow and proper sequence of the reveiling knowledge and logic.<br>1.5 . Speak / Express / Incorporate the language and style of the audience |
| **2. Apply the appropriate voice, tone and tense** | 2.1 Determine appropriate voice, tone and tense of the written materials according to audience requirements<br>2.2 Maintain consistent voice, tone and tense throughout written material |
| **3. Apply appropriate grammar, spelling and punctuation** | 3.1 Apply appropriate grammar conventions to a range of written contexts including use of numbers, quotations, and tables<br>3.2 Apply appropriate spelling and punctuation conventions in writing and editing tasks. |
| **4. Perform editing and proofreading tasks to meet requirements** | 4.1 Edit written material to ensure clear meaning through language and paragraphs, consistent voice, tone and tense<br>4.2 Copyedit written material by checking grammar, spelling and punctuation using standard editing conventions<br>4.3 Proofreading using style guides and by monitoring written material for errors |

**Knowledge & Understanding**

K1: main features of clear, concise and plain English language for written material

K2: grammar, punctuation and spelling conventions that meet the task requirements
K3: editing conventions used in substantive editing and copyediting of written material
K4: basic software used to write and collect feedback

**Critical Evidence(s) Required**

A person who demonstrates competency in this unit must be able to provide evidence of the ability to perform writing and editing tasks that is clear to the target audience and easy to navigate. The evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

**Performance requirements**

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Demonstrated evidence is required of the ability to:

- write and edit at least one written material (2500-4000 words) and edit another material written by another author (2500-4000 words), of different forms (e.g. blog, journal, book) that demonstrate use of:
    - clear and concise language
    - clear and logical paragraph structures
    - appropriate voice, tone, tense and language
    - plain English grammar, spelling and punctuation
    - accepted grammar conventions for a range of written contexts including use of numbers, quotation and tables
    - standard editing conventions
- complete editing and proofreading tasks using handwritten and digital methods
- accurately follow a style guide where required

follow relevant health and safety practices for writing tasks

***Basic Engineering Drawing and CAD (IT-112)***

**0714E&A32- Apply basic CAD software for Designing & Drawing**

**Overview:**

After completing this competency, the student will be able to draft drawings of architecture, machines, parts and layouts using CAD software as required in the industry.

| Competency Units | Performance Criteria |
|---|---|
| **CU1. Identify drawing requirements.** | P1. Determine the Requirements and purpose of drawing.<br>P2. Record the data related to the drawing task.<br>P3. Verify the data related to the drawing task. |
| **CU2. Create and Edit engineering drawing manually.** | P1. Identify and apply different drafting principles to produce drawing.<br>P2. Select appropriate drawing method for drafting.<br>P3. Verify drawing in accordance with safety standards and operating procedures (SOP). |
| **CU3. Identify engineering parts and related drawing issues.** | P1. Identify and organize list of engineering components.<br>P2. Draw and record part list according to standard operating procedures.<br>P3. Verify part list according to standard operating procedures. |
| **CU4. Identify elements of the CAD software interface and Plot a basic level drawing.** | P1. Create new drawing document using latest CAD software, Identifying file extensions, file locations.<br>P2. Sketch drawing using drawing tools, edit tools and modify tools.<br>P3. Draw the sketch using the Command line, Ribbon, Dynamic input and Menu browser. |
| **CU5. Create CAD drawing using multilayer and object editing tools** | P1. Create and managing multiple layers that define line color, line width, line type etc.<br>P2. Create drawing using object editing tools (such as fillet, chamfer, break, join, trim, extend, lengthen, and scale, arranging and patterning objects with move, copy, mirror, rotate, align, and array, Obtaining and editing object information through quick properties and Editing object properties.<br>P3. Create polylines, revision clouds, splines, editing and exploding polylines. |

| | |
|---|---|
| **CU6. Create CAD drawing using Text and non-pictorial information.** | P1. Differentiate the oblique, axonometric, and isometric drawings.<br>P2. Create isometric drawings, including isometric ellipses and arcs.<br>P3. Create section views (e.g., full, offset, half, aligned, revolved, removed, and broken out) and applying the hatch tool to depict material surfaces and solids.<br>P4. Insert tables and fields into a CAD drawing.<br>P5. Identify different industry standards for dimensioning |
| **CU7. Create basic 2D drawings in CAD software.** | P1. Draw lines, curves, circles, ellipses, rectangles, polygons, and donuts in CAD software.<br>P2. Identify the use of various types of Object Snaps and Auto tracking.<br>P3. Construct drawing points, construction, lines and rays.<br>P4. Create multi view drawings of an object<br>P5. Create partial and full auxiliary view |
| **CU8. Create 3D models of physical parts and assemblies.** | P1. Perform the modeling of the components and useful solid geometry.<br>P2. Produce assemblies from 3D models of component<br>P3. Draw first angle and third angle orthographic projections manually.<br>P4. Draw isometric projection manually.<br>P5. Convert 2D drawings to poly-lines and poly-lines to 3D object.<br>P6. Observe different views of 3D object using view ports<br>P7. Plot the multi views and shows the hidden features of a 3D object. |
| **CU9. Exporting CAD drawing to different media.** | P1. Identify the difference between model and paper space<br>P2. Create multiple layouts for a drawing.<br>P3. Use floating viewports using the correct paper size, orientation<br>P4. Plot drawings to scale, Outputting to different media |
| **CU10. Create photo rendered images** | P1. Create photo rendered images of components or assemblies, Save and label images to access for further use.<br>P2. Interpret source information<br>P3. Apply material properties using information supplied from source drawings<br>P4. Create photo rendered images of components or assemblies |
| **CU11. Apply reverse engineering of a physical model.** | P1. Create free hand sketches of industry accepted instruments<br>P2. Create part and assembly technical drawings in standard format. |

| | |
|---|---|
| | P3. Insert written information with more than one column using annotation styles that meet ISO standards.<br>P4. Produce print outs of drawings in sizes A0 to A4 to ISO standard. |

**Knowledge and understanding**

- Basic understanding of the customer requirement.
- Describe the CAD software tools, file generation and GUI.
- Explain basics of computer operating systems
- Explain Drafting principles and procedure to produce a drawing.
- Explain knowledge in the use of the CAD software interface for the purpose to Create 3D CAD models of parts and assemblies
- Explain the materials and processes for obtaining unprocessed work pieces
- Explain the output drawings in CAD
- Explain the process to transfer a real object to a 3D image & a technical drawing.
- Explain the rendering
- Explain the rules of technical drawing and the prevailing latest ISO standards that govern those rules.
- Explain the uses of lighting, scenes and decals to produce photo rendered images
- Knowledge and understanding of Issue related to final drawing draft.
- Learn the knowledge about different industrial standards for dimensioning.
- Learn the knowledge to be able to configure the parameters of the software.
- Understand the basics of drawing & its requirement.
- Understand the concept to modify a CAD drawing.
- Understand the key terms, concepts associated with drafting and the drafting profession.
- Understand the principles of technical drawing.
- Understand the usage of drafting in industries as an important aspect in their work.
- Understand the working with text and conveying no pictorial information in CAD software.
- Understanding of the skills necessary to create basic 2D CAD drawings

**Tools & Equipment**

| SN | |
|---|---|
| **1.** | Cloth, |
| **2.** | Computer installed with CAD software. |
| **3.** | Drafting machine, |
| **4.** | Drafting paper, |
| **5.** | Drawing materials, |
| **6.** | French Curves, Rulers, Compass, |
| **7.** | Pencil, Drafting board, |
| **8.** | Perspective machines, |
| **9.** | Printer/ plotter with all accessories |
| **10.** | Templates |
| **11.** | Thick draft paper, |

| | |
|---|---|
| **12.** | Tracing paper, |
| **13.** | Tracing tube, Inks |
| **14.** | T-square, |

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## Critical Evidence(s) Required

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

Evidence of the following is essential:

- Create 2D/3D drawing
- Perform Rendering

***Process Variable Measurements (IT-204)***

**0714E&A33- Install Temperature & Pressure Measuring Instruments/Devices**

**Overview:**

After completing this competency standard, the student will be able to understand the functions, uses, Maintenance & Installation of temperature & Pressure measuring devices.

| Competency Units | Performance Criteria |
|---|---|
| **CU1. Install the Temperature/Pressure measuring instruments.** | P1. Analyze the type of Instrument to be installed<br>P2. Select the appropriate type of instrument and the Scale of measurement<br>P3. Record the output values |
| **CU2. Measure the Temperature using Thermocouple & Resistance Thermocouple** | P1. Analyze the type of thermocouple to be installed<br>P2. Install the required thermocouple as per installation manual<br>P3. Analyze accuracy, power and flexibility of thermocouples<br>P4. Plot the temperature graph as required. |
| **CU3. Install Pressure Transducer & Transmitters.** | P1. Analyze the type of Pressure measuring instrument<br>P2. Install the Pressure transducer as per the installation guidelines<br>P3. Install the pressure Transmitter as per Installation guidelines<br>P4. Test & Calibrate the installed pressure measuring instrument |

| | |
|---|---|
| **CU4. Install Pressure Switch** | P1. Analyze the type of pressure switch to be installed<br>P2. Install the pressure switch as per instructions manual<br>P3. Test and Calibrate the pressure switch |

**Knowledge and understanding**

- Explain the principle of heat transfer
- Explain temperature and scales.
- Explain pressure, types, its units and the formulae.
- Differentiate the Gauge & Atmospheric pressure
- Differential Pressure controller
- And temperature controller
- Different types of thermocouples, heat sensing devices
- Explain thermocouple basic, its working principles and uses in industry.
- Explain the PTC & NTC resistance thermocouple basics, its working principles and uses in industry
- Explain the advantages and disadvantages of Thermocouples
- Explain pressure, transducer, Transmitter and their working principles
- Describe the uses of Pressure Transmitters and Transducers in industry
- Describe the advantages of pressure transducer & Transmitter
- Explain pressure, transmitter, its working and principle
- Describe the importance and requirement of pressure switch
- Describe the advantages of pressure switch

| **SN** | |
|---|---|
| **1.** | 4-20 map Devices |
| **2.** | Different types of thermocouples, heat sensing devices |
| **3.** | J type thermocouple |
| **4.** | K type thermocouple |
| **5.** | Mass flow controller |
| **6.** | Multi meter |
| **7.** | NTC thermocouple |
| **8.** | Pressure gauge |
| **9.** | Pressure monitor |
| **10.** | Pressure switch |
| **11.** | Pressure transducer |
| **12.** | Pressure transmitter |
| **13.** | PT-100, 1000 and RTD Thermocouple |
| **14.** | PTC thermocouple |

| | |
|---|---|
| **15.** | S type thermocouple |
| **16.** | Temperature Gun |
| **17.** | Temperature measuring Graphs |
| **18.** | Toolkit |

**Critical Evidence(s) Required**

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

Evidence of the following is essential:

- Install pressure switch in a circuit
- Use Thermocouple in a circuit

## 0714E&A34- Install Level Measuring Instruments/Device

**Overview:**
After completion of this competency standard the student will be able to grasp the basic concepts of level measurement, its uses and installation.

**Knowledge and understanding**

| Competency Units | Performance Criteria |
|---|---|
| **1. Install the Level Measurement device** | P1. Analyze the type of level measurement Instrument<br>P2. Classify the level measurement sensors<br>P3. Install the level measuring instruments as per the installations guidelines<br>P4. Test & Calibrate the level measuring device |
| **2. Install the optical Instrument for Level Measurement** | P1. Analyze the type of Optical instrument for level measurement<br>P2. Install the optical instrument as per installations guidelines<br>P3. Test and calibrate the optical instrument |
| **3. Install the Ultrasonic Level measuring Instruments** | P1. Analyze the type of Ultrasonic instrument for level measurement<br>P2. Install the Ultrasonic instrument as per installations guidelines<br>P3. Test and calibrate the Ultrasonic instrument |
| **Install the float instruments for Level measurement** | P1. Analyze the type of float level measuring device<br>P2. Install the float level measuring device as per installations manual<br>P3. Check & Calibrate the float level measuring device |
| **Install the capacitive Level measuring device** | P1. Analyze the type of capacitive level measuring device<br>P2. Install the capacitive level measuring device as per the installations manual<br>P3. Check and calibrate the capacitive level measuring device |

- Define the units of level and their conversion.
- Describe calibration and advantages of optical level measurement
- Describe the advantages of capacitive level measurement
- Describe the advantages of float level measurement
- Describe the advantages of ultrasonic level measurement
- Describe the importance and requirement of capacitive level measurement
- Describe the importance and requirement of float level measurement
- Describe the importance and uses optical level measurement
- Describe the uses of Ultrasonic measuring instruments in industry
- Explain capacitive level measurement & its working principle

- Explain float level measurement & its working principle
- Explain optical level measurement, its working and principle
- Explain the Direct & Indirect level measurement.
- Explain the importance of level measurement in industry
- Explain ultrasonic level measurement & its working principle

**Tools & Equipment**

| SN | |
|---|---|
| **1.** | Analog Level sensor |
| **2.** | capacitive level Devices and sensors |
| **3.** | Digital Level sensor |
| **4.** | float level sensor |
| **5.** | Horizontal and vertical |
| **6.** | Multi meter |
| **7.** | Optical level sensor |
| **8.** | Sonicator |
| **9.** | Toolkit |
| **10.** | Ultrasonic level sensor |

**Critical Evidence(s) Required**

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

Evidence of the following is essential:

- Working principal of level sensors
- Connection of optical sensors

## 0714E&A35- Install the Flow Measuring Instruments/Devices

**Overview:**

After completion of this competency standard the student will be able to grasp basic concepts, perform the uses and installation of Flow measurement.

| Competency Units | Performance Criteria |
|---|---|
| **CU1. Install the Flow Measuring instrument**<br>**CU2.** | P1. Analyze the type of flow measuring device<br>P2. Install the flow measuring device(Air and Liquid) as per the installations manual<br>P3. Check and calibrate the flow measuring device |
| **CU3. Install Differential Pressure Flow Meters** | P1. Analyze the type of differential pressure flow meter<br>P2.Install the differential pressure flow meter as per installations guideline<br>P3. Check and calibrate the differential pressure<br>flow meter |
| **CU4. Implement the Piston & Gear Flow Meters** | P1. Analyze the type of Piston flow meter<br>P2.Install the Piston flow meter as per installations guideline<br>P3. Check and calibrate the Piston flow meter |
| **CU5. Install the Sluice Gate & Weir Flow Meters** | P1. Analyze the type of Sluice Gate & Weir flow meter<br>P2.Install the Sluice Gate & Weir flow meter as per installations guideline<br>P3. Check and calibrate the Sluice Gate & Weir flow meter |

**Knowledge and understanding**

- Define flow and its types and measurements
- Define Mass, weight, Density, Velocity & their units
- Describe the function of Venturi Tubes and its working principle
- Describe the function of flow nozzle and its working principle
- Describe the function of gear flow meter and its working principle
- Describe the function of orifice plate and its working principle
- Describe the function of piston flow meter and its working principle
- Describe the function of Rota-meters (Variable Area) and its working principle
- Describe the function of Sluice Gate and its working principle
- Describe the function of weir and its working principle
- Describe the Reynold number & Reynold Equation.
- Enlist chemical and physical properties of fluids.
- Enlist flow rate meters.
- Explain differential pressure measurement flow meter & its working principle
- Explain open channel flow meter, its working and principle
- Explain positive displacement flow meter, its working and principle

**Tools & Equipment**

| SN | |
|---|---|
| 1. | Air Flow meter |
| 2. | Liquid flow meter |
| 3. | Mass flow meter |
| 4. | Differential Pressure Flow meter |
| 5. | Displacement |
| 6. | Pressure Flow meter |
| 7. | Multi meter |
| 8. | Toolkit |
| 9. | Calibrator• |
| 10. | Open channel Pressure Flow meter |

**Critical Evidence(s) Required**

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

Evidence of the following is essential:

- Working principal of flow meter
- Connection of Differential Pressure Flow Meters

## Metrology

**0714E&A36. Take measurements with graduated tools**

**Overview**: This competency standard covers the skills and knowledge required to take measurements Steel rule, Take measurements Hook rule, Take measurements Folding rule and Take measurements with Trammels.

| Competency Unit | Performance Criteria |
|---|---|
| **CU1. Take measurements Steel rule** | **P-1.** Place ruler on different work pieces.<br>**P-2.** Take dimension and record multiple readings on each work piece.<br>**P-3.** Take average of readings.<br>**P-4.** Record the results. |
| **CU2. Take measurements Hook rule** | **P-1.** Place hook rule on given different work piece.<br>**P-2.** Take dimension and record multiple readings on each work piece.<br>**P-3.** Take average of readings.<br>**P-4.** Record the results. |
| **CU3. Take measurements Folding rule** | **P-1.** Take suitable work piece for measurement.<br>**P-2.** Measure the dimensions of work pieces.<br>**P-3.** Compute surface area, volume, of given work pieces.<br>**P-4.** Record the results in data table. |
| **CU4. Take measurements with Trammels** | **P-1.** Open the trammel according to required dimension.<br>**P-2.** Draw circle or arc by fixing one point in the dot and rotate. |

### 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:

- Define Decimal and fraction of an inch
- Define Measurement techniques
- Describe Calculation of area, volume of geometric shapes.
- Define Arc and circle

## Critical Evidence(s) Required

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

- Perform measurement and take a 4 readings on each work piece and calculate the average reading.
- Draw circle or arc by fixing one point in the dot and rotate.

### Tools and Equipment

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

| S. No. | Items |
|---|---|
| 1. | Steel rule |
| 2. | Surface plate |
| 3. | Steps and collars |
| 4. | Hook rule |
| 5. | Folding rule |
| 6. | Trammel |

## 0714E&A37. Take measurements with combination set

**Overview**: This competency standard covers the skills and knowledge required to take measurements with Combination Set.

| Competency Unit | Performance Criteria |
|---|---|
| **CU1. Take Measurement with Square head** | **P-1.** Place the combination set on given drawing sheet.<br>**P-2.** Draw layout of a component with the help of combination square. |
| **CU2. Perform leveling with square head as spirit level** | **P-1.** Place the spirit level on horizontal work piece.<br>**P-2.** Check the deviation of bubbles<br>**P-3.** Level the surface by inserting shims.<br>**P-4.** Place square head on vertical work piece.<br>**P-5.** Note the deviation and correct the level.<br>**P-6.** Check the other geometrical shapes. |
| **CU3. Measure depth with square head as depth gauge** | **P-1.** Place the square head on work piece.<br>**P-2.** Apply force at the head to retain contact with the component.<br>**P-3.** Set square head and record the depth. |
| **CU4. Measure height with square head as height gauge** | **P-1.** Place the square head on work piece.<br>**P-2.** Measure height of work piece with and without the help of height gauge attachment. |

**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:

- Define Measurement techniques
- Define dimensioning of drawings and layouts

## Critical Evidence(s) Required

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

- Draw layout of a component with the help of combination square.
- Perform leveling /measure angle of surfaces with protractor Head

### Tools and Equipment

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

| S. No. | Items |
|---|---|
| 1. | Combination set |
| 2. | Surface plate |
| 3. | Scriber |
| 4. | Tri square |
| 5. | Divider |
| 6. | Round stock |

## 0714E&A38. Take measurements through various gauges

**Overview**: This competency standard covers the skills and knowledge required to take measurements with various type of gauges.

| Competency Unit | Performance Criteria |
|---|---|
| **CU1. Take measurement with fixed gauge and plug gauge.** | **P-1.** Check/Compare the dimension of provided work piece against reference standard with the help of fixed gauge.<br>**P-2.** Insert plug gauge into the work piece to determine either dimension is of acceptable size or over size. |
| **CU2. Take measurement with adjustable gauge** | **P-1.** Insert both “go” and “not go” gauges in the work piece.<br>**P-2.** Check the size and record the results. |
| **CU3. Take measurement with small hole gauge** | **P-1.** Insert the small hole gauge of require size into the work piece<br>**P-2.** Record the result. |
| **CU4. Take measurement with telescope gauge** | **P-1.** Insert the telescope gauge into the work piece<br>**P-2.** Adjust the gauge and determine the size of work piece. |

**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:

- Define dimensioning and measurement techniques
- Define and differentiate the gauges type

**Critical Evidence(s) Required**

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

- Draw layout of a component with the help of combination square.
- Perform leveling /measure angle of surfaces with protractor Head

**Tools and Equipment**

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

| S. No. | Items |
|---|---|
| 1. | Fix gauge |
| 2. | Surface plate |
| 3. | Surface gauge |
| 4. | Dial indicator |
| 5. | Adjustable gauge |
| 6. | Hole gauge |
| 7. | Telescope |

## 0714E&A39. Perform measurements through Micrometre

**Overview**: This competency standard covers the skills and knowledge required to take measurements with micrometre.

| Competency Unit | Performance Criteria |
|---|---|
| **CU1. Take measurement with outside micro-meter** | **P-1.** Clean the gauge and surface of work piece<br>**P-2.** Open slightly larger than the part to be measured<br>**P-3.** Set anvil squarely against reference surface of part<br>**P-4.** Using ratchet, slowly until it click once<br>**P-5.** Record reading and make average. |
| **CU2. Take measurement with inside micrometer** | **P-1.** Clean the gauge and surface of work piece.<br>**P-2.** Open gauge slightly smaller than the part to be measured<br>**P-3.** Set anvil squarely against reference surface of part with ratchet, slowly until it click once.<br>**P-4.** Record reading and make average. |
| **CU3. Take measurement with depth micrometer** | **P-1.** Clean the gauge and surface of work piece.<br>**P-2.** Access the depth of groove by steel rule<br>**P-3.** Insert the suitable insertion rod<br>**P-4.** Place the depth micrometer gauge on the deeper groove and take reading. |
| **CU4. Measure threads with micrometer** | **P-1.** Clean the gauge and the threads of work piece.<br>**P-2.** Use the suitable set of thread shape tips according to thread size which is to be measured.<br>**P-3.** Record the reading. |
| **CU5. Take measurement with Vernier micrometer** | **P-1.** Clean the surface.<br>**P-2.** Place specimen on the surface plate<br>**P-3.** Take reading accurately.<br>**P-4.** Calculate mean reading. |

**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:

- Define Measurement techniques

- Describe dimensioning of drawings and layouts

## Critical Evidence(s) Required

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

- Perform measurement with inside micrometer
- Perform the use of hole gauge
- Perform to operate telescope gauge

**Tools and Equipment**

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

| S. No. | Items |
|---|---|
| 1. | Inside Micrometer |
| 2. | Outside Micrometer |
| 3. | Depth Micrometer |
| 4. | Screw thread Micrometer |

## 0714E&A40. Measure dimensions with Vernier Calliper

**Overview**: This competency standard covers the skills and knowledge required to take measurements with Vernier caliper.

| Competency Unit | Performance Criteria |
|---|---|
| **CU1. Take measurement with Vernier caliper** | **P-1.** Clean the gauge and surface of work piece.<br>**P-2.** Place the work piece on surface plate.<br>**P-3.** Open the lock screws.<br>**P-4.** Slide the jaws up to the width or size of jaws.<br>**P-5.** Open slightly larger than the part to be measured.<br>**P-6.** Set anvil squarely against reference surface of part<br>**P-7.** Maintain the proper pressure on the jaws with screw.<br>**P-8.** Lock the movable jaw with knurled screw<br>**P-9.** Measure and record the dimensions. |
| **CU2. Take measurement with height gauge** | **P-1.** Clean the gauge and surface of work piece<br>**P-2.** Hold the work piece on angle plate.<br>**P-3.** Open the lock screws.<br>**P-4.** Set the height gauge on stud to check it with fine adjusting screw.<br>**P-5.** Lock the measuring head.<br>**P-6.** Record the reading. |
| **CU3. Take measurement with Vernier depth gauge** | **P-1.** Clean the gauge and surface of work piece<br>**P-2.** Hold the work piece on sample plate.<br>**P-3.** Open the lock screws.<br>**P-4.** Insert the gauge inside the work piece with fine adjusting screw.<br>**P-5.** Lock the measuring head.<br>**P-6.** Record the reading |

**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:

- Define Vernier calipers, height gauge and Vernier depth gauge
- Define different type of Measurement techniques

## Critical Evidence(s) Required

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

- Perform measurement (inside, outside & depth) with Vernier caliper
- Identify Vernier scale and Main scale
- Define least count

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

| S. No. | Items |
|---|---|
| 1. | Vernier caliper |
| 2. | Height Gauge |
| 3. | Vernier Depth Gauge |

## 0714E&A41. Perform different measurements

**Overview**: This competency standard covers the skills and knowledge required to take measurements with Dial caliper, Dial thickness gauge, Dial indicator, Gauge blocks, Tool maker's microscope, Coordinate measuring machine

| Competency Unit | Performance Criteria |
|---|---|
| **CU1. Take measurement with dial calliper** | **P-1.** Set the pointer on zero properly<br>**P-2.** Set the work piece correctly<br>**P-3.** Read the dial scale accurately<br>**P-4.** Record the results |
| **CU2. Take measurement with dial thickness gauge** | **P-1.** Remove zero error<br>**P-2.** Set the work piece properly<br>**P-3.** Measure the size accurately<br>**P-4.** Record the results |
| **CU3. Take measurement with dial Indicator** | **P-1.** Set the Indicator on magnetic stand<br>**P-2.** Set the pointer on zero<br>**P-3.** Set the pointer on work piece<br>**P-4.** Read the dial scale |
| **CU4. Exercise on gauge blocks** | **P-1.** Adjust the gauge block as per desired size<br>**P-2.** Hold the specimen in position<br>**P-3.** Measure the angle accurately sine bar and gauge blocks |
| **CU5. Exercise on tool makers microscope** | **P-1.** Prepare the microscope for examining the job<br>**P-2.** Hold the job on anvil<br>**P-3.** Observe the size and profile of the job by setting eye piece<br>**P-4.** Record the observations |
| **CU6. Practice on Profile Projector** | **P-1.** Make complete setting of work piece on Profile Projector<br>**P-2.** P2. Set the axis<br>**P-3.** P3. Observe the size |
| **CU7. Practice Of Digital Instruments** | **P-1.** Select digital instrument and specimen for measurement.<br>**P-2.** Take measurement of specimen with digital instrument |
| **CU8. Measure with coordinate** | **P-1.** Hold the job properly. |

| Competency Unit | Performance Criteria |
|---|---|
| **measuring machine** | **P-2.** Set and locate zero point.<br>**P-3.** Take the dimensions for different coordinates properly.<br>**P-4.** Take point to point/linear measurements.<br>**P-5.** Take measurements profile in 2D and 3D. |
| **CU9. Calculate tolerance and allowances** | **P-1.** Measure the job for upper and lower limits.<br>**P-2.** Calculate the maximum and minimum size.<br>**P-3.** Calculate tolerance and allowance<br>**P-4.** Represent tolerance in results. |

**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:

- Define Measurement techniques
- Define Digital measuring instruments
- Describe Knowledge of dimensioning and layouts
- Define ISO standards of fits and tolerance
- Describe Knowledge of components e.g. shafts, holes etc

**Critical Evidence(s) Required**

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

- Define different type of measuring techniques
- Perform to operate dial indicator
- Define how to operate Vernier caliper
- Define how to adjust the gauge block as per desired size

**Tools and Equipment**

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

| S. No. | Items |
|---|---|
| 1. | Vernier caliper |
| 2. | Dial thickness gauge |
| 3. | Dial indicator |
| 4. | Gauge blocks |
| 5. | Tool makers microscope |
| 6. | Coordinate measuring machines |
| 7. | ISO tables of fits and tolerance |
| 8. | Measurement tools |

## Basic Electrical Engineering

### 0714E&A42. Operate Measuring Instruments

**Overview**: This competency standard covers the skills and knowledge related to Calibration in measurement technology and metrology is the comparison of measurement values delivered by a device under test with those of a calibration standard of known accuracy. The term calibration means just the act of comparison, and does not include any subsequent adjustment.

| Competency Unit | Performance Criteria |
|---|---|
| CU1. Operate Ampere meter | **P1.** Identify ampere meter.<br>**P2.** Make a parallel circuit with three different resistors on breadboard and connect with the power supply.<br>**P3.** Adjust proper range setting of ampere meter as per load.<br>**P4.** Connect ampere meter in series to each resistor to measure the current.<br>**P5.** Turn on the supply and note the reading of current against each resistor. |
| CU2. Operate Volt meter | **P1.** Identify volt meter.<br>**P2.** Make a series circuit with three different resistors on bread board.<br>**P3.** Adjust proper range setting of Volt meter as per load.<br>**P4.** Connect volt meter across any resistor in circuit<br>**P5.** Turn on the supply and note the reading of voltage drop against each resistor. |
| CU3. Operate ohm meter. | **P1.** Identify Ohm meter.<br>**P2.** Adjust proper range of ohm meter as per resistance value.<br>**P3.** Disconnect the resistor from the circuit<br>**P4.** Connect ohm meter with resistor in series and parallel combination.<br>**P5.** Record the reading. |

**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:

- Define current and its unit.
- Describe series circuit.
- Enlist the name of various meters
- Describe purpose of ampere meter
- Describe how ampere meter is connected in the circuit.
- Define voltage and its unit.
- Describe parallel circuit.
- Describe purpose of volt meter

- Describe how voltmeter is connected in the circuit.
- Define resistance and its unit
- Describe purpose of ohm meter

## Critical Evidence(s) Required

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

- Perform turn on the supply and note the reading of current/voltage against each resistor.
- Perform to Adjust the scale for measurements.
- Perform probe selection for appropriate measurement.

### Tools and Equipment

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

| S. No. | Items |
|---|---|
| 1. | Voltmeters |
| 2. | Ammeter |
| 3. | Ohmmeters |
| 4. | Multi meters. |
| 5. | Resistors of different values. |

## 0714E&A43. Verify Ohm's Law & Kirchhoff's Law by Implementing Series/Parallel Circuits

**Overview**: This competency standard covers the skills and knowledge related to Make series circuit and measure voltage and verify KVL, make parallel circuit and measure current and verify KCL, verify resistance of a resistor, Find unknown value of ohm's law.

| Competency Unit | Performance Criteria |
|---|---|
| CU1. Make series circuit and measure voltage and verify KVL | **P1.** Construct series circuit with different resistors on bread board and give supply voltage.<br>**P2.** Measure the voltage across each resistor.<br>**P3.** Record the reading.<br>**P4.** Sum the voltage drop across each resistor.<br>**P5.** Compare the total voltage with the applied voltage |
| CU2. Make parallel circuit and measure current and verify KCL | **P1.** Construct parallel circuit with different resistors on bread board.<br>**P2.** Connect ampere meter in series to each resistor to measure the current.<br>**P3.** Record the reading.<br>**P4.** Sum the current of each resistor<br>**P5.** Compare the sum with total consumed current. |
| CU3. Verify resistance of a resistor using color codes | **P1.** Select the 4 colour band resistor.<br>**P2.** Determine the value of resistor using colour code.<br>**P3.** Connect ohm meter across the resistor.<br>**P4.** Record reading form ohm meter.<br>**P5.** Compare both reading. |
| CU4. Measure resistance of incandescent lamp. | **P1.** Take 40 W lamp and 1 digital or analogy ohmmeter.<br>**P2.** Adjust zero with shortening the ohmmeter leads.<br>**P3.** Connect the ohmmeter with lamp terminal and note resistance<br>**P4.** Repeat this method for 60 & 100 W lamp |

**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:

- Define Describe characteristics of series circuit
- Describe the use of volt meter
- Describe characteristics of parallel circuit
- Describe the use of ampere meter
- Describe color codes and its use.
- Describe the purpose of ohm meter
- Explain Kirchhoff's voltage law.
- State Kirchhoff's current law

## Critical Evidence(s) Required

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

- Adjust zero error with shortening the analog ohmmeter leads.
- Perform series circuit and measure voltage across each resistor and verify KVL
- Perform parallel circuit and measure current of each resistor and verify KCL
- Verify resistance of a resistor using color code and verify using ohmmeter.

### Tools and Equipment

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

| S. No. | Items |
|---|---|
| 1. | Voltmeters |
| 2. | Ammeter |
| 3. | Ohmmeters |
| 4. | Multi meters. |
| 5. | Resistors of different values. |
| 6. | Battery |
| 7. | Copper wire. |
| 8. | Rheostat |
| 9. | Incandescent lamp |

**0714E&A44. Measure Electrical Power, Energy, Power Factor & Determine Phase Sequence**

**Overview**: This competency standard covers the skills and knowledge required to Measure single phase and poly-phase electrical para meters using Volt-Ampere meter, watt meter & Measure consumed energy with Energy meter.

| Competency Unit | Performance Criteria |
|---|---|
| CU1. Measure power using Multimeter method | **P1.** Construct Select the load to calculate the power and give supply.<br>**P2.** Measure the voltage and current by using Multimeter.<br>**P3.** Find power using power formula. |
| CU2. Measure power using watt meter | **P1.** Construct Select a load to calculate the power and connect watt meter across the load.<br>**P2.** Power-ON the supply and measure the power. |
| CU3. Measure single phase AC Power | **P1.** Select a load to calculate the power and appropriate supply.<br>**P2.** Measure the voltage and current using Multimeter.<br>**P3.** Calculate the power using power. |
| CU4. Measure three phase AC Power | **P1.** Select a load to calculate the power with appropriate supply.<br>**P2.** Measure the voltage, current using Multimeter for each phase.<br>**P3.** Calculate the power using power formula. |
| CU5. Measure consumed energy with Energy meter | **P1.** Connect phase line of AC supply to the energy meter.<br>**P2.** Connect AC load to the output terminals of energy meter.<br>**P3.** Power up the supply and take reading of energy in terms of unit after few minutes form display. |
| CU6. Measure power factor with voltmeter, ampere meter and watt meter | **P1.** Connect voltmeter & ampere meter with inductive load (Motor)<br>**P2.** Connect watt meter and measure.<br>**P3.** Connect AC supply and take the readings of volt, ampere and watt meter.<br>**P4.** Utilize the above readings and calculate power factor using power formula P=VI Cos Ø |
| CU7. Measure power factor with power factor meter | **P1.** Connect current coil of power factor meter in series to the load.<br>**P2.** Voltage coil of power factor meter in parallel to the load.<br>**P3.** Power the supply and measure the value of power factor |

| | |
|---|---|
| | form the meter. |

**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:

- Define AC/D.C power.
- Explain how to measure power of the circuit with meter.
- Differentiate between electrical and mechanical power.
- Define three phase system
- Define wattmeter
- Define relationship between the individual wattmeter readings and the total three phase power
- Use of wattmeter to measure three phase load.
- Explain advantages of three wattmeter method.
- Explain measurement of power in delta and star connection
- Define power factor
- Effect of improved power factor on load Current

**Critical Evidence(s) Required**

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

- Adjust Measure single phase power using Volt-Ampere meter method, watt meter & Measure consumed energy with Energy meter.
- Perform electrical connection verification as per observation.

**Tools and Equipment**

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

| S. No. | Items |
|---|---|
| 1. | Voltmeter. |
| 2. | Ammeter |
| 3. | Wattmeter. |
| 4. | Connecting Leads. |
| 5. | Power Supply. |
| 6. | Screw Driver & Plier. |
| 7. | Single Phase Load or 100 watt lamp. |
| 8. | Single phase Energy Meter with connecting leads. |
| 9. | Ammeter & Voltmeter |
| 10. | Capacitor bank |
| 11. | Single phase power factor meter |
| 12. | Connecting leads as per required. |
| 13. | Three phase supply source. |

| | |
|---|---|
| 14. | Safety switch |
| 15. | Phase sequence meter |
| 16. | Change over switch |
| 17. | Three phase supply |

**0714E&A45. Implement Electromagnetism to See Various Effects & Verify Faradays Law**

**Overview**: This competency standard covers the skills and knowledge required to Implement Electromagnet, Implement circuit to determine the effect on current carrying conductor in magnetic field, Determine the effect on conductor by varying the current with the help of rheostat, plot magnetic lines of forces of bar magnet, Verify Faradays law by moving magnet in side coil, Verify Faradays law by moving coil near the magnet field, Verify EMF through induction.

| Competency Unit | Performance Criteria |
|---|---|
| CU1. Demonstrate Electromagnetism | **P1.** Take iron nail (approximately 3 inches in length) as iron core and make 30 to 40 turns of thin coated copper wire to form a coil.<br>**P2.** Connect dry cell battery with coil wound on the iron nail.<br>**P3.** Bring iron nail near the iron pieces and demonstrate the observation. |
| CU2. Implement circuit to determine the effect on current carrying conductor in magnetic field. | **P1.** Take copper rod (5 cm in length) and connect wires across it.<br>**P2.** Give DC supply to copper rod through rheostat.<br>**P3.** Place current carrying copper rod inside the horse shoe magnet.<br>**P4.** De assembles the Simple DC motor and connects the power leads directly to the electrodes of the armature and observes the rotation. |
| CU3. Determine the effect on conductor by varying the current with the help of rheostat.single phase AC Power | **P1.** Reduce the rheostat resistance<br>**P2.** Record the effect on copper rod.<br>**P3.** Increase the rheostat resistance<br>**P4.** Record the effect on copper rod. |
| CU4. Plot magnetic lines of forces of bar magnet. | **P1.** Place a bar magnet on paper and outline its boundary with the help of lead pencil.<br>**P2.** Place a compass needle at one side the magnet.<br>**P3.** Mark points on paper where the compass needle stop.<br>**P4.** Repeat the same procedure till compass reach at the other end of magnet.<br>**P5.** Change the position of compass needle near the magnetic pole and repeat the procedure for P3 to P4. |

| | |
|---|---|
| CU5. Verify Faradays law by moving magnet in side coil. | **P1.** Construct a coil with hollow iron cylinder (approximately 3 inches in length 1.5 inch in diameter.) and make 150 to 200 turns on it.<br>**P2.** Connect Galvanometer with coil.<br>**P3.** Move permanent magnet inside the coil fast and slow and record the effect on reading of Galvanometer.<br>**P4.** Hold the magnet inside the coil and do not move, now record the effect on reading of Galvanometer. |
| CU6. Verify Faradays law by moving coil near the magnet field. | **P1.** Construct a coil with hollow iron cylinder (approximately 3 inches in length 1.5 inch in diameter.) and make 150 to 200 turns on it<br>**P2.** Connect Galvanometer with coil<br>**P3.** Fix permanent magnet and move the coil fast and slow on it and record the effect on reading of Galvanometer<br>**P4.** Hold the coil near the magnetic field do not move, now record the effect on reading of Galvanometer |
| CU7. Verify EMF through induction. | **P1.** Take step down transformer and connect its secondary with a Galvanometer and primary winding with a DC battery through a rheostat<br>**P2.** Continuously variate the rheostat and observe the reading on the Galvanometer |

**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:

- Describe magnet and magnetism
- Describe function of iron core
- Explain how to find the movement of current caring conductor which is placed in magnetic field
- Explain Fleming's left-hand rule
- Define magnetic lines of force.
- Define magnetic field.
- Explain How magnetic lines of force travel with respect to each other
- Explain first law of Michal Faraday
- Explain law of Faraday
- Explain how to find the direction of induced EMF
- Describe role of magnetic strength in Faraday's Law
- Describe role of conductor's length or turns in Faraday's Law
- Define Lenz's Law
- Explain Faraday's first law of Electro-Magnetic Induction

**Critical Evidence(s) Required**

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

- Measure the AC voltage, current, frequency, time period with oscilloscope, RMS value and average value of AC signal with oscilloscope

**Tools and Equipment**

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

| S. No. | Items |
|---|---|
| 1. | Iron nail (as core) |
| 2. | Thin coated copper wire |
| 3. | Rheostat |
| 4. | Current carrying conductor |
| 5. | Horse shoe magnet. |
| 6. | Dry cell battery |
| 7. | Magnet. |
| 8. | Connecting leads. |
| 9. | Transformer |
| 10. | Compass needle |
| 11. | Coil |
| 12. | Bar Magnet |
| 13. | Paper |
| 14. | Lead pencil. |
| 15. | Galvanometer |

## 0714E&A46. Verify Series and Parallel Combination of Capacitors & Determine Break Down Voltage of Capacitor.

**Overview**: This competency standard covers the skills and knowledge required to Implement a series circuit of capacitors, implement a parallel circuit of capacitors, and determines the breakdown voltage of low voltage capacitor.

| Competency Unit | Performance Criteria |
|---|---|
| CU1. Implement a series circuit of capacitors. | **P1.** Assemble a series circuit of capacitors with 3 different values.<br>**P2.** Connect the battery and apply 10 voltages to the combination of capacitors<br>**P3.** Measure the voltage across each capacitor connected in series<br>**P4.** Add the voltage of each capacitor and verify is it equal to applied voltage. |

| | |
|---|---|
| | **P5.** Use voltage of each capacitor and its value to find the charge on each capacitor. |
| CU2. Implement a parallel circuit of capacitors. | **P1.** Assemble a parallel circuit of capacitors with 3 different values.<br>**P2.** Connect the battery and apply 10 voltages to the combination of capacitors.<br>**P3.** Use applied voltage and value of capacitor to find the charge on each capacitor.<br>**P4.** Use total voltage and total capacitance to verify the net charge on the capacitor. |
| CU3. Determine the breakdown voltage of low voltage capacitor | **P1.** Take a capacitor of 6.3 rated volts.<br>**P2.** Connect it across a 0-30 volts D.C variable supply<br>**P3.** Very slowly increased the voltage of variable supply from zero to rated 6.3v, and then higher than rated, and observed carefully the capacitor and to voltmeter reading.<br>**P4.** After slowly increasing at critical position of voltage, the capacitor will be burnt, and smoked. Note that voltages. |

**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:

- Describe breakdown of capacitors
- Describe breakdown voltage of capacitors
- Describe the factor affecting the life of a capacitor
- Describe what is charging of capacitor

## Critical Evidence(s) Required

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

- Determine the breakdown voltage of capacitor

**Tools and Equipment**

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

| S. No. | Items |
|---|---|
| 1. | Capacitors, 4.7 µF |
| 2. | Capacitors, 10, 100 & 8.2 µF. |
| 3. | Voltmeter |

| | |
|---|---|
| 4. | D.C. power supply unit |
| 5. | Bridging plugs |
| 6. | Connecting leads |
| 7. | Multimeter. (With option of Capacitance measurement). |
| 8. | Variable D.C powers supply 0-30 Voltas. |
| 9. | Capacitor (Sanyo Operated Volts 6.3 V, SE 30) |
| 10. | D.C Analog or Preferably Digital Voltmeter Range 0-50V. |
| 11. | L.E.D (3 to 9 V) Optional. |
| 12. | Connecting Leads |

## Basic Electronics (Analog)

### 0714E&A47. Identify Basic Electronics Components

**Overview**: This competency standard covers the skills and knowledge required to Identify Various Diodes, Resistors, Capacitors and Inductor in the circuit. After this competency standard the candidate will be able to identify variety of basic electronic components and their usage in industry.

| Competency Unit | Performance Criteria |
|---|---|
| **CU1. Identify Various Diodes** | **P-1.** Identify the types of Diodes<br>**P-2.** Identify the polarities of diode.<br>**P-3.** Check the voltage across the diode in forward and reverse Biased |
| **CU2. Identify Resistors in circuit** | **P-1.** Identify Resistor & its types<br>**P-2.** Recognize numeric coding & colour coding of resistor<br>**P-3.** Design series & Parallel circuit of Resistor<br>**P-4.** Use formulas for Series & parallel circuit of resistors |
| **CU3. Identify Capacitor in circuit** | **P-1.** Identify Capacitor & its types<br>**P-2.** Recognize polarity & rating of Capacitor<br>**P-3.** Design Parallel and series circuit of Capacitor<br>**P-4.** Use formulas for Series & parallel circuit of Capacitor |
| **CU4. Identify Inductor in circuit** | **P-1.** Identify an Inductor<br>**P-2.** Recognize Coding & Rating of Inductor<br>**P-3.** Use formulas for Series & Parallel circuit of Inductor<br>**P-4.** Analyze Circuit of Inductor |
| **CU5. Identify transistor and its types** | **P-1.** Identify types of transistors<br>**P-2.** Define it's switching functions<br>**P-3.** Analyze circuit of transistors |

**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:

- Describe the diodes, polarities & their applications in circuits

- Explain the uses of Multimeter & power Supply
- Explain the data sheets
- Explain Resistor & their applications in Parallel & Series circuits
- Describe Capacitor& their applications in circuits
- Describe the Inductor & their applications in circuits
- Describe the transistors, types & their applications in circuits

## Critical Evidence(s) Required

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

- Identify the components (e.g. diodes, resistors, capacitors, transistors and inductors) and its types.
- Test the components.

### Tools and Equipment

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

| S. No. | Items |
|---|---|
| 1. | Multimeter |
| 2. | Power supply |
| 3. | Diode |
| 4. | Resistor |
| 5. | Inductor |
| 6. | Capacitor |
| 7. | Transistors |
| 8. | Bread board |
| 9. | Data sheets |

## 0714E&A48. Design a Rectifier using Diode

**Overview**: This competency standard covers the skills and knowledge required to the parameter of Diode and characteristic curve of Diode, designing of Full Wave Rectifier (two diode rectifiers) and designing of Full Wave Rectifier using Diode Bridge. This competency standard will help the candidate in construction of Diode rectifier and its uses in industry.

| Competency Unit | Performance Criteria |
|---|---|
| **CU1. Identify The parameter of Diode and Draw the characteristic curve of Diode** | **P-1.** Identify the Diodes and their terminal (Anode and Cathode) with the Help of Datasheet<br>**P-2.** Measure different parameters (Current, Voltage, and power rating) of Diode using multimeter<br>**P-3.** Implement the Diode in forward and Revers Configuration<br>**P-4.** Perform the forward and reveres biases operation<br>**P-5.** Monitor the Output waveform on oscilloscope<br>**P-6.** Draw the characteristic curves in forward and reverse Biased<br>**P-7.** Generate the Lab report |
| **CU2. Design half wave and Full Wave Rectifier (two diode rectifier** | **P-1.** Select Full Wave and half wave Rectifier components<br>**P-2.** Draw circuit Diagram of half wave Rectifier<br>**P-3.** Draw circuit Diagram of Full Wave Rectifier<br>**P-4.** Observe the Input and Output wave form on oscilloscope and multimeter<br>**P-5.** Calculate the ripple Factor<br>**P-6.** Measure output voltage using proper formulas |
| **CU3. Design Full Wave Rectifier using Diode Bridge** | **P-1.** Select Full Wave Rectifier components<br>**P-2.** Draw circuit Diagram of Full Wave Rectifier<br>**P-3.** Observe the Input and Output wave form on oscilloscope and multimeter<br>**P-4.** Calculate the ripple Factor<br>**P-5.** Measure output voltage |

**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:

- Study the basic of diodes, & their applications in circuits
- Understand Multimeter & power Supply
- Understand the data sheets
- Explain basics of diodes
- Explain the uses of multimeter
- Explain the uses oscilloscope
- Explain the basics of AC & DC voltages

## Critical Evidence(s) Required

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

- Observe the Input and Output wave form of Half wave and Full wave Rectifier on oscilloscope and multimeter

### Tools and Equipment

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

| S. No. | Items |
|---|---|
| 1. | Oscilloscope |
| 2. | Diode |
| 3. | Resistor |
| 4. | Variable DC power supply |
| 5. | Soldering iron |
| 6. | Connecting wire |
| 7. | Breadboard |
| 8. | Multimeter |
| 9. | Wire cutter |
| 10. | Wire stripper |
| 11. | Soldering wire |

## 0714E&A49. Carry out Diode Application

**Overview**: This competency standard covers the skills and knowledge required to make voltage regulator using Zener diode and make Seven Segment Using Light Emitting Diode. After completing this competency standard, the student will be able to design a voltage regulator circuit using a Zener diode to maintain a constant DC output voltage across the load in spite of variations in the input voltage or changes in the load current.

| Competency Unit | Performance Criteria |
|---|---|
| **CU1. Make voltage regulator using Zener diode** | **P-1.** Draw the voltage Regulator circuit<br>**P-2.** Select the Zener diode and components as per requirement for voltage regulator<br>**P-3.** Placed the components on bread board for voltage regulator circuits.<br>**P-4.** Measure Input and outputs of the voltage regulator<br>**P-5.** Verify the required output<br>**P-6.** Generate the output report |
| **CU2. Make Seven Segment Using Light Emitting Diode** | **P-1.** Draw the Seven Segment Display Circuit<br>**P-2.** Select required components for seven segment display<br>**P-3.** Placed the components for Seven Segment Display Circuit<br>**P-4.** Perform basic operations of Seven Segment Display and Verify the required output<br>**P-5.** Generate the output report |

**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:

- Learn basic knowledge of Diode & its applications
- Learn to use Multimeter & power Supply
- Understand the data sheets
- Learn adequate knowledge of hand tools
- Learn to Solder the Components
- Learn basic knowledge of LED & its applications

**Critical Evidence(s) Required**

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

- Make voltage regulator using Zener diode
- Make Seven Segment Using Light  Emitting Diode

**Tools and Equipment**

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

| S. No. | Items |
|---|---|
| 1. | Oscilloscope |
| 2. | Zener diode |
| 3. | Resistor |
| 4. | Variable DC power supply |
| 5. | Soldering iron |
| 6. | Connecting wire |
| 7. | Breadboard |
| 8. | Light Emitting diode |
| 9. | Multimeter |
| 10. | Seven Segment |

## 0714E&A50. Implement Bipolar Junction Transistor (BJT) in Different Applications

**Overview**: This competency standard covers the skills and knowledge required to perform the Biasing of Transistors, Implement Transistor as an amplifier using CB Configuration, Implement Transistor as an amplifier using CC Configuration, Implement Transistor as an amplifier using CE Configuration, Design the circuit of Class A Power Amplifier and Implement BJT as a switch After completion of this competency standard the student will be able to regulate the current or voltage flow and implement a switch for electronic signals.

| Competency Unit | Performance Criteria |
|---|---|
| **CU1. Perform the Biasing of Transistors** | **P-1.** Identify the Transistor & its types.<br>**P-2.** Identify the base collector & Emitter of transistors<br>**P-3.** Perform the standard Biasing of PNP & NPN Transistor |
| **CU2. Implement Transistor as an amplifier using CB Configuration .** | **P-1.** Draw the Circuit of CB configuration of transistor<br>**P-2.** Select the components for CB configurations.<br>**P-3.** Place the components on breadboard for CB amplifier<br>**P-4.** Calculate the gain of transistor in CB modes.<br>**P-5.** Draw VI characteristics curve for CB |
| **CU3. Implement Transistor as an amplifier using CC Configuration .** | **P-1.** Draw the Circuit of CC configuration of transistor<br>**P-2.** Select the components for CC configurations.<br>**P-3.** Place the components on breadboard for CC amplifier<br>**P-4.** Calculate the gain of transistor in CC modes.<br>**P-5.** Draw VI characteristics curve for CC |
| **CU4. Implement Transistor as an amplifier using CE Configuration .** | **P-1.** Draw the Circuit of CE configuration of transistor<br>**P-2.** Select the components for CE configurations.<br>**P-3.** Place the components on breadboard for CE amplifier |

| Competency Unit | Performance Criteria |
|---|---|
| | **P-4.** Calculate the gain of transistor in CE modes.<br>**P-5.** Draw VI characteristics curve for CE |
| **CU5. Design the circuit of Class A Power Amplifier** | **P-1.** Identify the Class of a Power Amplifier<br>**P-2.** Select the component for Class A Power Amplifier<br>**P-3.** Implement the circuit of PNP OR NPN transistor in Class A Power Amplifier Configuration<br>**P-4.** Analyse the different parameter of Class A Power Amplifier<br>**P-5.** Monitor the Output waveform on oscilloscope<br>**P-6.** Draw the characteristic curves of Class A Power Amplifier<br>**P-7.** Calculate the Voltage gain and Power Gain of Class A Power Amplifier<br>**P-8.** Generate the Lab report |
| **CU6. Implement BJT as a switch.** | **P-1.** Draw the Circuit of transistor in switching configuration.<br>**P-2.** Select the components for switching circuits<br>**P-3.** Place the components on breadboard.<br>**P-4.** Operate an LED using transistor as a switch<br>**P-5.** Measure the output and generate the report |

**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:

- Learn basic concepts of transistor & Biasing
- Study semiconductor theory
- Study the datasheet of transistor
- Learn basics of Coupling Capacitor.
- Study the basic of BJTs, & their applications in circuits
- Learn the V-I Characteristics
- Understand Multimeter, Oscilloscope & power Supply

**Critical Evidence(s) Required**

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

- Operate Transistor as an amplifier using CB, CE and CC Configuration.

- Operate Transistor as Switch.

**Tools and Equipment**

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

| S. No. | Items |
|---|---|
| 1. | Oscilloscope |
| 2. | Transistor |
| 3. | Resistor |
| 4. | Variable DC power supply, Multimeter |
| 5. | Soldering iron |
| 6. | Connecting wire |
| 7. | Breadboard |
| 8. | Light Emitting diode |

## 0714E&A51. Implement Field Effect Transistor (FET) in Different Applications

**Overview**: This competency standard covers the skills and knowledge required to perform the Biasing of FET, Implement MOSFET as a switch, Draw the VI characteristics curves for FETs, Design the circuit of Common Drain (CD) Amplifier, Design the circuit of Common Gate (CG) Amplifier, design a switching Circuit Using MOSFET and Design a Low voltage transistor based regulated power supply. After completion of this competency standard the student will be able to implement the FET (Field Effect Transistor) to control the current flow through the device.

| Competency Unit | Performance Criteria |
|---|---|
| **CU1. Perform the Biasing of FET** | **P-1.** Identify the FET & its types.<br>**P-2.** Identify the Drain, Gate & Source terminal of FET<br>**P-3.** Perform the standard Biasing of MOSFET (N-channel, P-channel)<br>**P-4.** Measure the Gate-Source voltage (Vgs) & Threshold Voltage (Vth) |
| **CU2. Implement MOSFET as a switch.** | **P-1.** Draw the Circuit of MOSFET in switching configuration.<br>**P-2.** Select the components for switching circuits<br>**P-3.** Place the components on breadboard<br>**P-4.** Operate an LED using MOSFET as a switch<br>**P-5.** Measure the output and generate the report |
| **CU3. Draw the VI characteristics curves for FETs** | **P-1.** Construct an amplifier circuit using FETs<br>**P-2.** P2. Apply Vds &Vgs<br>**P-3.** P2. Measure the drain current<br>**P-4.** P4. Draw VI characteristic curves |
| **CU4. Design the circuit of Common Drain (CD) Amplifier** | **P-1.** Identify the FET and there terminal (gate, drain and Sources) whit the Help of Datasheet<br>**P-2.** Select the components for Common Drain (CD) amplifier<br>**P-3.** Implement the circuit of Common Drain (CD) amplifier<br>**P-4.** Analyse the different parameter of Common |

| Competency Unit | Performance Criteria |
|---|---|
| | Drain (CD) amplifier<br>**P-5.** Monitor the Output waveform on oscilloscope<br>**P-6.** Draw the characteristic curves of Common Drain (CD) amplifier<br>**P-7.** Generate the Lab report |
| **CU5. Design the circuit of Common Gate (CG) amplifier** | **P-1.** Identify the FET and there terminal (gate, drain and Sources) whit the Help of Datasheet<br>**P-2.** Select the components for Common Gate (CG) amplifier<br>**P-3.** Implement the circuit of Common Gate (CG) amplifier<br>**P-4.** Analyse the different parameter of Common Gate (CG) amplifier<br>**P-5.** Monitor the Output waveform on oscilloscope<br>**P-6.** Draw the characteristic curves of Common Gate (CG) amplifier<br>**P-7.** Generate the Lab report |

**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:

- Learn the basics of FET
- Learn the concept of FET Biasing.
- Learn the power rating of FET
- Study the datasheet of FET
- Learn the behavior of current and voltage in FET's
- Learn the Vgs, VDs, Idss& Rds as per datasheet.
- Understand Multimeter & power Supply
- Understand the data sheets
- Study the basic of FETs, & their applications in circuits
- Understand Multimeter, Oscilloscope & power Supply

**Critical Evidence(s) Required**

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

- Operate MOSFET as a switch
- Operate MOSFET as Amplifier

**Tools and Equipment**

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

| S. No. | Items |
|---|---|
| 1. | Oscilloscope |
| 2. | FET Transistor |
| 3. | Resistor |
| 4. | Variable DC power supply |
| 5. | Soldering iron |
| 6. | Connecting wire |
| 7. | Breadboard |
| 8. | Multimeter |
| 9. | Wire cutter |
| 10. | Wire Stripper |
| 11. | Soldering Wire |

## 0714E&A52. Implement Thyristor Family in Various Application

**Overview**: This competency standard covers the skills and knowledge required to Implement the UJT in electronic circuits as switch, Implement the SCR in electronic circuits as switch and Construct the dimmer circuit using Diac & Triac. After the completion of this standard the candidate will be able to use Uni junction Transistor (UJT), Silicon-controlled rectifier (SCR) in power Control Application.

| Competency Unit | Performance Criteria |
|---|---|
| **CU1. Implement the UJT in electronic circuits as switch** | **P-1.** Identify the UJT terminal<br>**P-2.** Draw the circuit of switch using UJT.<br>**P-3.** Select the components for the relaxation oscillator circuits<br>**P-4.** Construct the relaxation oscillator circuits using UJT<br>**P-5.** Measure the input and output voltage<br>**P-6.** Generate the lab report |
| **CU2. Implement the SCR in electronic circuits as switch** | **P-1.** Identify the SCR terminals<br>**P-2.** Draw the circuit of switch using SCR.<br>**P-3.** Select the components for SCR switching circuits.<br>**P-4.** Construct the SCR switching circuit.<br>**P-5.** Apply the trigger Pulse and Check out the desired outputs |
| **CU3. Construct the dimmer circuit using Diac &Triac.** | **P-1.** Identify the terminals of Diac & Triac.<br>**P-2.** Draw the dimmer circuit using Diac & Triac.<br>**P-3.** Select the components for the dimmer circuit.<br>**P-4.** Construct the dimmer circuits.<br>**P-5.** Control the load using dimmer<br>**P-6.** Generate the lab report |

**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:

- Learn the basics of UJT
- Understand the data sheets
- Learn adequate knowledge of hand tools
- Learn basics of SCR
- Learn the basics of diac & triac
- Learn the uses of oscilloscope, power Supply & Multimeter

## Critical Evidence(s) Required

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

- Implement the UJT and SCR in electronic circuits as switch
- Make the dimmer circuit using Diac & Triac.

### Tools and Equipment

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

| S. No. | Items |
|---|---|
| 1. | Oscilloscope |
| 2. | UJT, |
| 3. | SCR |
| 4. | DIAC |
| 5. | TRIAC |
| 6. | Variable DC power supply, |
| 7. | Multimeter |
| 8. | Soldering iron, wire |
| 9. | Breadboard or trainer |
| 10. | Connecting wire |
| 11. | Wire Stripper |
| 12. | Wire Cutter |

## 0714E&A53. Applications of Operation Amplifier

**Overview**: This competency standard covers the skills and knowledge required to construct a Non-inverting amplifier, an Inverting amplifier, differentiator and comparator circuit using operational amplifier.

| Competency Unit | Performance Criteria |
|---|---|
| **CU1. Construct a Non-inverting amplifier using operational amplifier** | **P-1.** Identify the Operational amplifier terminals (Inverting, Non-inverting Inputs & Outputs) with the Help of Datasheet<br>**P-2.** Identify different parameters (Current, Voltage, and power rating) of Op-Amp using datasheet.<br>**P-3.** Draw the Schematic diagram of non-Inverting Op-Amp.<br>**P-4.** Select the components for Non-Inverting Op-Amp.<br>**P-5.** Implement Non-Inverting Op-Amp circuit.<br>**P-6.** Perform the operations of Non-Inverting Op-Amp circuit.<br>**P-7.** Measure the output voltage & gain<br>**P-8.** Generate the Output report |
| **CU2. Construct an Inverting amplifier using operational amplifier** | **P-1.** Identify the Operational amplifier terminals (Inverting, Non-inverting Inputs & Outputs) with the Help of Datasheet<br>**P-2.** Identify different parameters (Current, Voltage, and power rating) of Op-Amp using datasheet.<br>**P-3.** Draw the Schematic diagram of Inverting Op-Amp.<br>**P-4.** Select the components for Inverting Op-Amp.<br>**P-5.** Implement Inverting Op-Amp circuit.<br>**P-6.** Perform the operations of Inverting Op-Amp circuit.<br>**P-7.** Measure the output voltage & gain |

| Competency Unit | Performance Criteria |
|---|---|
| | **P-8.** Generate the Output report |
| **CU3. Construct a differentiator circuit using operational amplifier** | **P-1.** Draw the Schematic diagram of differentiator circuit using Op-Amp.<br>**P-2.** Select the components for differentiator circuit.<br>**P-3.** Implement differentiator circuit.<br>**P-4.** Perform the operations of differentiator circuit.<br>**P-5.** Measure the output waveform<br>**P-6.** Draw the characteristic curves of differentiator circuit.<br>**P-7.** Generate the Output report |
| **CU4. Construct a integrator circuit using operational amplifier** | **P-1.** Draw the Schematic diagram of integrator circuit using Op-Amp.<br>**P-2.** Select the components for integrator circuit.<br>**P-3.** Implement integrator circuit.<br>**P-4.** Perform the operations of integrator circuit.<br>**P-5.** Measure the output waveform<br>**P-6.** Draw the characteristic curves of integrator circuit.<br>**P-7.** Generate the Output report |
| **CU5. Construct a Comparator circuit using operational amplifier** | **P-1.** Draw the Schematic diagram of Comparator circuit using Op-Amp.<br>**P-2.** Select the components for Comparator circuit.<br>**P-3.** Implement Comparator circuit.<br>**P-4.** Perform the operations of Comparator circuit.<br>**P-5.** Check the output for different input conditions |

**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:

- Study the basics of Op-Amp & their applications in circuits
- Understand Multimeter, Oscilloscope & power Supply & their applications
- Understand the data sheets

**Critical Evidence(s) Required**

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

- Perform to use Operational Amplifier IC in different applications

**Tools and Equipment**

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

| S. No. | Items |
|---|---|
| 1. | Functions Generator |
| 2. | Multimeter |
| 3. | Digital Oscilloscope |
| 4. | Capacitors |
| 5. | Resistors |
| 6. | Op-Amp |
| 7. | DC Power supply |
| 8. | Breadboard |
| 9. | Connecting leads |

***Soft Skills:***

**0714E&A54. Develop workplace policy and procedures for sustainability**

**Overview**: This competency standard covers the skills and knowledge required to develop and implement a workplace sustainability policy and to modify the policy to suit changed circumstances. It applies to individuals with managerial responsibilities who undertake work developing approaches to create, monitor and improve strategies and policies within workplaces and engage with a range of relevant stakeholders and specialists.

| Competency Unit | Performance Criteria |
|---|---|
| **CU1. Develop workplace sustainability policy** | **P1.** Define scope of sustainability policy<br>**P2.** Gather information from a range of sources to plan and develop policy<br>**P3.** Identify and consult stakeholders as a key component of the policy development process<br>**P4.** include appropriate strategies in policy at all stages of work for minimizing resource use, reducing toxic material and hazardous chemical use and employing life cycle management approaches<br>**P5.** Make recommendations for policy options based on likely effectiveness, timeframes and cost<br>**P6.** Develop policy that reflects the organization s commitment to sustainability as an integral part of business planning and as a business opportunity<br>**P7.** Agree to appropriate methods of implementation, outcomes and performance indicators |
| **CU2. Communicate workplace sustainability policy** | **P1.** Promote workplace sustainability policy, including its expected outcome, to key stakeholders<br>**P2.** Inform those involved in implementing the policy about expected outcomes, activities to be undertaken and assigned responsibilities |
| **CU3. Implement workplace sustainability policy** | **P1.** Develop and communicate procedures to help implement workplace sustainability policy<br>**P2.** Implement strategies for continuous improvement in resource efficiency<br>**P3.** Establish and assign responsibility for recording systems to track continuous improvements in sustainability approaches |
| **CU4. Review workplace sustainability policy implementation** | **P1.** Review workplace sustainability policy implementation<br>**P2.** Investigate successes or otherwise of policy<br>**P3.** Monitor records to identify trends that may require remedial action and use to promote continuous improvement of performance<br>**P4.** Modify policy and or procedures as required to ensure improvements are made |

**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:

- Define outline the environmental or sustainability legislation, regulations and codes of practice applicable to the organization identify internal and external sources of information and explain how they can be used to plan and develop the organization s sustainability policy
- Explain policy development processes and practices
- Describe organizational systems and procedures that relate to sustainability
- Describe typical barriers to implementing policies and procedures in an organization and possible strategies to address them.

## Critical Evidence(s) Required

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

A person who demonstrates competency in this unit must be able to provide evidence of the ability to develop workplace policy and procedures for sustainability. The evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

## Performance requirements

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Demonstrated evidence is required of the ability to:

- Scope and develop organizational policies and procedures that comply with legislative requirements and support the organization s sustainability goals covering at a minimum:
    - minimizing resource use
    - resource efficiency
    - reducing toxic material and hazardous chemical use
    - employing life cycle management approaches
    - continuous improvement

- Plan and implement sustainability policy and procedures including:
    - agreed outcomes
    - performance indicators

    - activities to be undertaken
    - assigned responsibilities
    - record keeping, review and improvement processes
- Consult and communicate with relevant stakeholders to generate engagement with sustainability policy development, implementation and continuous improvement
- Review and improve sustainability policies.

## 0714E&A55. Maintain Professionalism in the Workplace

**Overview**: This competency standard covers the skills and knowledge required to maintain a professional image in the workplace, including behaving ethically, demonstrating motivation, respecting timeframes and maintaining personal appearance.

| Competency Unit | Performance Criteria |
|---|---|
| CU1. Respect work timeframes | **P1.** Demonstrate punctuality in meeting, set working hours and times.<br>**P2.** Utilize working hours only for working and follow company regulations.<br>**P3.** Complete work tasks within deadlines according to order of priority<br>**P4.** Supervisors are informed of any potential delays in work times or projects. |
| CU2. Maintain personal appearance and hygiene | **P1.** Clean hair, body and nails regularly.<br>**P2.** Wear suitable cloths for the workplace, and respect local and cultural contexts<br>**P3.** Meet specific company dress code requirements |
| CU3. Maintain adequate distance with colleagues and clients | **P1.** Respect personal space of colleagues and clients with reference to local customs and cultural contexts.<br>**P2.** Keep sufficient distance from others<br>**P3.** Avoid cross transmission of infections (especially through respiration). |
| CU4. Work in an ethical manner | **P1.** Follow company values/ethics codes of ethics and/or conduct, policies and guidelines.<br>**P2.** Use company resources in accordance with company ethical standards.<br>**P3.** Conduct personal behavior and relationships in accord with ethical standards and company policies.<br>**P4.** Undertake work practices in compliance with company ethical standards, organizational policy and guidelines.<br>**P5.** Instruct co-workers on ethical, lawful and reasonable directives.<br>**P6.** Share Company values/practices with co-workers using appropriate behaviour and language.<br>**P7.** Report work incidents/situations and/or resolved in accordance with company protocol/guidelines. |

**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:

- Define outline the environmental or sustainability legislation, regulations and codes of practice Explain application of good manners and right conduct
- Explain basic practices for oral and personal hygiene
- Describe common products used for oral and personal hygiene
- Describe the company code of conduct/values
- Describe the Company regulations, performance and ethical standards
- Explain work responsibilities/job functions
- Describe communication skills
- Describe workplace hygiene standards

## Critical Evidence(s) Required

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

A person who demonstrates competency in this unit must be able to provide evidence of the ability to maintain professionalism in the workplace the evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

## Performance requirements

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Demonstrated evidence is required of the ability to:

- Clarify and affirm work values/ethics/concepts consistently in the workplace;
- Comply with required working times;
- Conduct work practices satisfactorily and consistently, in compliance with work ethical standards, organizational policy and guidelines;
- Develop suitable hygiene

Keep adequate distance while interacting with colleagues and clients.

**0714E&A56. Manage personal work priorities and professional development**

**Overview**: This competency standard covers the skills and knowledge required to create systems and process to organize information and prioritize tasks. It applies to individuals working in managerial positions who have excellent organizational skills. The work ethic of individuals in this role has a significant impact on the work culture and patterns of behaviour of others as managers at this level are role models in their work environment.

| Competency Unit | Performance Criteria |
|---|---|
| CU1. Establish personal work goals | **P1.** Serve as a positive role model in the workplace through personal work planning<br>**P2.** Ensure personal work goals, plans and activities reflect the organization s plans, and own responsibilities and accountabilities<br>**P3.** Measure and maintain personal performance in varying work conditions, work contexts and when contingencies occur |
| CU2. Set and meet own work priorities | **P1.** Take initiative to prioritize and facilitate competing demands to achieve personal, team and organizational goals and objectives<br>**P2.** Use technology efficiently and effectively to manage work priorities and commitments<br>**P3.** Maintain appropriate work-life balance, and ensure stress is effectively managed and health is attended to |
| CU3. Develop and maintain professional competence | **P1.** Assess personal knowledge and skills against competency standards to determine development needs, priorities and plans<br>**P2.** Seek feedback from employees, clients and colleagues and use this feedback to identify and develop ways to improve competence<br>**P3.** P3 Identify, evaluate, select and use development opportunities suitable to personal learning style/s to develop competence<br>**P4.** Participate in networks to enhance personal knowledge, skills and work relationships<br>**P5.** Identify and develop new skills to achieve and maintain a competitive edge |

**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:

- Explain principles and techniques involved in the management and organization of:
- Define performance measurement

- Describe personal behavior, self-awareness and personality traits identification
- Describe personal development plan
- Describe personal goal setting
- Describe time management
- Describe management development opportunities and options for self
- Describe methods for achieving a healthy work-life balance
- Define organization policies, plans and procedures
- Explain types of learning style/s and how they relate to the individual
- Describe types of work methods and practices that can improve personal performance.

**Critical Evidence(s) Required**

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

A person who demonstrates competency in this unit must be able to provide evidence of the ability to manage personal work priorities and professional development. The evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

**Performance requirements**

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Demonstrated evidence is required of the ability to:

- Demonstrate use business technology to create and use systems and processes to organize and priorities tasks and commitments
- measure and maintain personal work performance including assessing competency against competency standards and seeking feedback
- maintain an appropriate work-life balance to manage personal health and stress
- participate in networks
- develop a personal development plan which includes career objectives and an action plan
- Develop new skills.

## 0714E&A57. Manage workforce planning

**Overview**: This competency standard covers the skills and knowledge required to manage planning in relation to an organization's workforce including researching requirements, developing objectives and strategies, implementing initiatives and monitoring and evaluating trends. It applies to individuals who are human resource managers or staff members with a role in a policy or planning unit that focuses on workforce planning.

| Competency Unit | Performance Criteria |
|---|---|

| | |
|---|---|
| CU1. Research workforce requirements | **P1.** Review current data on staff turnover and demographics<br>**P2.** Assess factors that may affect workforce supply<br>**P3.** Establish the organization's requirements for a skilled and diverse workforce |
| CU2. Develop workforce objectives and strategies | **P1.** Review organizational strategy and establish aligned objectives for modification or retention of the workforce<br>**P2.** Consider strategies to address unacceptable staff turnover, if required<br>**P3.** Define objectives to retain required skilled labour<br>**P4.** Define objectives for workforce diversity and cross-cultural management<br>**P5.** Define strategies to source skilled labour<br>**P6.** Communicate objectives and rationale to relevant stakeholders<br>**P7.** Obtain agreement and endorsement for objectives and establish targets<br>**P8.** Develop contingency plans to cope with extreme situations |
| CU3. Implement initiatives to support workforce planning objectives | **P1.** Implement action to support agreed objectives for recruitment, training, redeployment and redundancy<br>**P2.** Develop and implement strategies to assist workforce to deal with organizational change<br>**P3.** Develop and implement strategies to assist in meeting the organization's workforce diversity goals<br>**P4.** Implement succession planning system to ensure desirable workers are developed and retained<br>**P5.** Implement programs to ensure workplace is an employer of choice |
| CU4. Monitor and evaluate workforce trends | **P1.** Review workforce plan against patterns in exiting employee and workforce changes<br>**P2.** Monitor labour supply trends for areas of over- or under-supply in the external environment<br>**P3.** Monitor effects of labour trends on demand for labour<br>**P4.** Survey organizational climate to gauge worker satisfaction<br>**P5.** Refine objectives and strategies in response to internal and external changes and make recommendations in response to global trends and incidents<br>**P6.** Regularly review government policy on labour demand and supply<br>**P7.** Evaluate effectiveness of change processes against agreed objectives. |

**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:

- Explain current information about external labor supply relevant to the specific industry or skill requirements of the organization
- Describe industrial relations relevant to the specific industry
- Describe labor force analysis and forecasting techniques

**Critical Evidence(s) Required**

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

A person who demonstrates competency in this unit must be able to provide evidence of the ability to manage workforce planning. The evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

**Performance requirements**

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Demonstrated evidence is required of the ability to:

- Review and interpret information from a range of internal and external sources to identify:
    - current staff turnover and demographics
    - labor supply trends factors that may affect workforce supply
    - organization's workforce requirements objectives and strategies
- Manage workforce planning including developing, implementing, monitoring and reviewing strategies to meet workforce needs
- Review relevant trends and supply and demand factors that will impact on an organization's workforce
- Develop a workforce plan that includes relevant research and specific strategies to ensure access to a skilled and diverse workforce.

**0714E&A58. Undertake project work**

**Overview**: This competency standard covers the skills and knowledge required to undertake a straightforward project or a section of a larger project. It covers developing a project plan, administering and monitoring the project, finalizing the project and reviewing the project to identify lessons learned for application to future projects. This unit applies to individuals who play a significant role in ensuring a project meets timelines, quality standards, budgetary limits and other requirements set for the project.

| Competency Unit | Performance Criteria |
|---|---|

| | |
|---|---|
| CU1. Define project | **P1.** Access project scope and other relevant documentation<br>**P2.** Define project stakeholders<br>**P3.** Seek clarification from delegating authority of issues related to project and project parameters<br>**P4.** Identify limits of own responsibility and reporting requirements<br>**P5.** Clarify relationship of project to other projects and to the organization's objectives<br>**P6.** Determine and access available resources to undertake project |
| CU2. Develop project plan | **P1.** Develop project plan in line with the project parameters<br>**P2.** Identify and access appropriate project management tools<br>**P3.** Formulate risk management plan for project, including Work Health and Safety (WHS)<br>**P4.** Develop and approve project budget<br>**P5.** Consult team members and take their views into account in planning the project<br>**P6.** Finalize project plan and gain necessary approvals to commence project according to documented plan |
| CU3. Administer and monitor project | **P1.** Take action to ensure project team members are clear about their responsibilities and the project requirements<br>**P2.** Provide support for project team members, especially with regard to specific needs, to ensure that the quality of the expected outcomes of the project and documented time lines are met<br>**P3.** Establish and maintain required recordkeeping systems throughout the project<br>**P4.** Implement and monitor plans for managing project finances, resources and quality<br>**P5.** Complete and forward project reports as required to stakeholders<br>**P6.** Undertake risk management as required to ensure project outcomes are met<br>**P7.** Achieve project deliverables |
| CU4. Finalize project | **P1.** Complete financial recordkeeping associated with project and check for accuracy<br>**P2.** P2 Ensure transition of staff involved in project to new roles or reassignment to previous roles<br>**P3.** P3 Complete project documentation and obtain necessary sign-offs for concluding project |

**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:

- Describe examples of project management tools and how they contribute to a project
- Describe types of documents and other sources of information commonly used in defining the parameters of a project
- Explain processes for identifying and managing risk in a project
- Describe the organization's mission, goals, objectives and operations and how the project relates to them

**Critical Evidence(s) Required**

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

A person who demonstrates competency in this unit must be able to provide evidence of the ability to undertake project work. The evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

**Performance requirements**

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Demonstrated evidence is required of the ability to:

- Define the parameters of the project including:
  - project scope
  - project stakeholders, including own responsibilities
  - relationship of project to organizational objectives and other projects
  - reporting requirements
  - resource requirements
- Use project management tools to develop and implement a project plan including:
  - deliverables
  - work breakdown
  - budget and allocation of resources
  - timelines
  - risk management
  - recordkeeping and reporting
- Consult and communicate with relevant stakeholders to generate input and engagement in planning, implementing and reviewing the project
- Provide support to team members to enable them to achieve deliverables and to transition them as appropriate at completion of the project
- Finalize the project including documentation, sign-offs and reporting

Review and document the project outcomes.

## 0714E&A59. Prepare and implement negotiation

**Overview**: This competency standard covers the skills and knowledge required to prepare for and participate in a process of negotiation.

| Competency Unit | Performance Criteria |
|---|---|
| CU1. Prepare for the negotiation | **P1.** Identify objectives and preferred outcome of the negotiation and determine minimum acceptable outcome<br>**P2.** Understand in relation to what can be offered and what is needed from the other party<br>**P3.** Gather information regarding the other party – objectives,<br>**P4.** needs, preferences, resources, what they want to achieve - in<br>**P5.** order to determine best negotiating points<br>**P6.** List and rank the issues to consider concessions that may be made. |

| | |
|---|---|
| | **P7.** Find examples and refine negotiation argument.<br>**P8.** Check information to ensure it is correct and up-to-date.<br>**P9.** Develop a negotiation plan that includes information about the other party and its interests and a set of responses and strategies to the anticipated tactics.<br>**P10.** Prepare an agenda in advance, which includes discussion topics, participants, location and schedule |
| CU2. Participate in negotiations | **P1.** Analyse all aspects of the incident for degree of hazard, priorities, optional outcomes and appropriate strategies<br>**P2.** Analyse and determine strategies and priorities on the incident sought from a range of sources<br>**P3.** Assess long term objectives against resources and priorities<br>**P4.** Apply a range of communication techniques to make and maintain contact with the key people<br>**P5.** Provide clear and factual information to enable an honest and realistic assessment of the interests of the key people and their positions<br>**P6.** Resolve the conflict and express their likely consequences clearly and do an analysis of the benefits<br>**P7.** Reassess points of disagreements for common positive positions |
| CU3. Coordinate support services | **P1.** Assess the need for support services in terms of the determined strategies and priorities<br>**P2.** Negotiate the resources of support services according to established procedures and availability<br>**P3.** Provide information on strategies to support services and maintain the communication<br>**P4.** Delegate roles and responsibilities according to expertise and resources |
| CU4. Restore order | **P1.** Assess the incidents for degree of risk and take appropriate action to reduce and remove the impact of the incident and restore order<br>**P2.** Take action designed to minimize risk and the preserve the safety and security of all involved<br>**P3.** Take action to prevent the escalation of the incident appropriate to the circumstances and agreed procedures.<br>**P4.** Carry out the use of force for the restoration of control and the maintenance of security in the least restrictive manner.<br>**P5.** Complete reports accurately and clearly provided to the appropriate authority promptly<br>**P6.** Review, evaluate and analyse the incident and the organizational response to it and report it promptly and accurately. |
| CU5. Provide leadership, direction and guidance to | **P1.** Link between the function of the group and the<br>**P2.** goals of the organization<br>**P3.** Participate in decision making routinely to develop, |

| | |
|---|---|
| the work group | implement and review work of the group and to allocate responsibilities where appropriate<br>**P4.** Give opportunities and encouragement to others to develop new and innovative work practices and strategies<br>**P5.** Identify conflict and resolve with minimum disruption to work group function<br>**P6.** Provide staff with the support and supervision necessary to perform work safely and without risk to health<br>**P7.** Allocate tasks within the competence of staff and support with appropriate authority, autonomy and training<br>**P8.** Supervise appropriately the changing priorities and situations and takes into account the different needs of individuals and the requirements of the task |

**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:

Explain organization's policies, guidelines and procedures related to control and surveillance, safety and preventing and responding to incidents and breaches of orders covered in the range of variables.

- Explain organization's management and accountability systems
- Describe teamwork principles and strategies
- Define the principles of effective communication
- Describe the guidelines for use of equipment and technology
- Explain code of conduct

## Critical Evidence(s) Required

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

A person who demonstrates competency in this unit must be able to provide evidence of the ability to solve problems which jeopardize safety and security. The evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

## Performance requirements

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Demonstrated evidence is required of the ability to:

- evidence of effective communication strategies including negotiation, counseling, mediation, advocacy demonstrated under pressure working effectively in a team environment
- evidence of knowledge and application of organizations policies, procedures and
- guidelines for critical incidents
- evidence of accurate and safe use of all emergency equipment
- evidence of managing effective outcomes using strategic planning
- team leadership and situational analysis

## 0714E&A60. Manage Meetings.

**Overview :**

This unit describes the skills and knowledge required to manage a range of meetings including overseeing the meeting preparation processes, chairing meetings, organizing the minutes and reporting meeting outcomes. It applies to individuals employed in a range of work environments who are required to organize and manage meetings within their workplace, including conducting or managing administrative tasks in providing agendas and meeting material. They may work as senior administrative staff or may be individuals with responsibility for conducting and chairing meetings in the workplace.

| Unit of Competency | Performance Criteria |
|---|---|
| **CU1** Prepare for meetings | **P1** Develop agenda in line with stated meeting purpose<br>**P2** Ensure style and structure of meeting are appropriate to its purpose<br>**P3** Identify meeting participants and notify them in accordance with organizational procedures<br>**P4** Confirm meeting arrangements in accordance with requirements of meeting<br>**P5** Dispatch meeting papers to participants within designated timelines |
| **CU2** Conduct meetings | **P1** Chair meetings in accordance with organizational requirements, agreed conventions for type of meeting and legal and ethical requirements<br>**P2** Conduct meetings to ensure they are focused, time efficient and achieve the required outcomes<br>**P3** Ensure meeting facilitation enables participation, discussion, problem-solving and resolution of issues<br>**P4** Brief minute-taker on method for recording meeting notes in accordance with organizational requirements and conventions for type of meeting |
| **CU3** Follow up meetings | **P1** Check transcribed meeting notes to ensure they reflect a true and accurate record of the meeting and are formatted in accordance with organizational procedures and meeting conventions |

| | |
|---|---|
| | **P2** Distribute and store minutes and other follow-up documentation within designated timelines, and according to organizational requirements<br>**P3** Report outcomes of meetings as required, within designated timelines |

Knowledge and understanding

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

- outline meeting terminology, structures, arrangements
- outline responsibilities of the chairperson and explain group dynamics in relation to managing meetings
- describe options for meetings including face-to-face, teleconferencing, web-conferencing and using webcams
- Identify the relevant organizational procedures and policies regarding meetings, chairing and minutes including identifying organizational formats for minutes and agendas.

**Critical Evidence(s) Required**

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

A person who demonstrates competency in this unit must be able to provide evidence of the ability to manage meetings. The evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

Performance requirements

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Demonstrated evidence is required of the ability to**:**

- apply conventions and procedures for formal and informal meetings including**:**
    - developing and distributing agendas and papers
    - identifying and inviting meeting participants

    - organizing and confirming meeting arrangements
    - running the meeting and following up
- organize, take part in and chair a meeting
- record and store meeting documentation
- Follow organizational policies and procedures.

## 0714E&A61. Organize schedules

**Overview**: This competency standard covers the skills and knowledge required to manage appointments and diaries for personnel within an organization, using manual and electronic diaries, schedules and other appointment systems. It applies to individuals employed in a range of work environments who provide administrative support to teams and individuals.

| Competency Unit | Performance Criteria |
|---|---|
| CU1. Establish schedule requirements | **P1.** Identify organizational requirements and protocols for diaries and staff planning tools<br>**P2.** Identify organizational procedures for different types of appointments<br>**P3.** Determine personal requirements for diary and schedule items for individual personnel<br>**P4.** Establish appointment priorities and clarify in discussion with individual personnel |
| CU2. Manage schedules | **P1.** Identify recurring appointments and deadlines, and schedule these in accordance with individual and organizational requirements<br>**P2.** Establish availability of attendees, and schedule new appointments in accordance with required timelines and diary commitments<br>**P3.** Negotiate alternative arrangements and confirm when established appointments are changed<br>**P4.** Record appointments and manage schedules in accordance with organizational policy and procedures |

**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:

- Identify the key provisions of relevant legislation, standards and codes that affect aspects of business operations or the achievement of team goals
- Describe organizational requirements for managing appointments for personnel within the organization
- Summarize the range of appointment systems that could be used
- Outline important considerations when managing the schedules of others.

## Critical Evidence(s) Required

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

A person who demonstrates competency in this unit must be able to provide evidence of the ability to organize schedules. The evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

## Performance requirements

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Demonstrated evidence is required of the ability to:

- Appropriately manage the schedules of various individuals through a process of careful planning and negotiation.

## 0714E&A62. Identify and communicate trends in career development

**Overview**: This competency standard covers the skills and knowledge required to communicate effectively, Use specialized counselling interviewing skills and use advanced and specialized communication skills in the client-counsellor relationship. This unit applies to individuals whose job role involves working with clients on personal and psychological issues within established policies, procedures and guidelines.

| Competency Unit | Performance Criteria |
|---|---|
| CU1. Communicate effectively | **P1.** Identify communication barriers and use strategies to overcome these barriers in the client-counsellor relationship<br>**P2.** P2 Facilitate the client-counsellor relationship through selection and use of micro skills<br>**P3.** P3 Integrate the principles of effective communication into work practices<br>**P4.** P4 Observe and respond to non-verbal communication cues<br>**P5.** P5 Consider and respond to the impacts of different communication techniques on the client-counsellor relationship in the context of individual clients<br>**P6.** P6 Integrate case note taking with minimum distraction |
| CU2. Use specialized counseling interviewing skills | **P1.** Select and use communication skills according to the sequence of a counselling interview<br>**P2.** Identify points at which specialized counselling interviewing skills are appropriate for inclusion<br>**P3.** Use specialized counselling communication techniques based on their impacts and potential to enhance client development and growth<br>**P4.** Identify and respond appropriately to strong client emotional reactions |
| CU3. Evaluate own communication | **P1.** Reflect on and evaluate own communication with clients<br>**P2.** Recognize the effect of own values and beliefs on communication with clients<br>**P3.** Identify and respond to the need for development of own skills and knowledge |

**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:

- Describe Legal and ethical considerations for communication in counseling practice, and how these are applied in individual practice:
- Describe codes of conduct/practice
- Define discrimination
- Describe duty of care
- Define human rights
- Describe practitioner/client boundaries
- Describe privacy, confidentiality and disclosure
- Define rights and responsibilities of workers, employers and clients
- Describe work role boundaries responsibilities and limitations of the counselor role
- Describe principles of person-centered practice
- Define key objectives of counseling interviewing
- Describe stages of a counseling interview
- Define potential impacts of using different communication skills and techniques in counseling contexts
- Define communication techniques and micro-skills including:
- Describe attending behaviors active listening, reflection of content feeling, summarizing
- Describe questioning skills open, closed, simple and compound questions
- Describe client observation skills
- Describe noting and reflecting skills
- Describe providing client feedback
- Describe specialized counseling communication techniques, and how they are used, including:
    - challenging
    - reframing
    - focusing
- Define components of the communication process including:
    - encoder
    - decoder
- Describe primary factors that impact on the communication process including:
    - context
    - participants
    - rules
    - messages
    - channels
    - noise
    - feedback
- Describe communication barriers and resolution strategies, including:
    - environmental
    - physical
    - individual perceptions
    - cultural issues
    - language
    - age issues
    - disability
- Describe observational techniques including:
    - facial expressions
    - non-verbal behavior

    - posture
    - silence
- Describe ways in which different people absorb information, including:
    - visual
    - auditory
    - kinesthetic
    - obstacles to the counseling process
- Define impacts of trauma and stress on the communication process, including on:
    - concentration and attention
    - memory
    - use of verbal and written language
    - use of body language
    - challenging within the counseling session
    - self-evaluation practices, including:
    - how to recognize own biases
    - Impact of own values on the counseling relationship

## Critical Evidence(s) Required

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

A person who demonstrates competency in this unit must be able to provide evidence of the ability to apply specialist interpersonal and counseling interview skills. The evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

## Performance requirements

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Demonstrated evidence is required of the ability to:

- Perform interviewed at least 3 different clients using specialized interpersonal communication and counseling interviewing skills, including:
- Perform micro-skills and communication techniques, including:
    - attending behaviors active listening,
    - reflection of content, summarizing
    - questioning skills open, closed, simple and compound questions
    - client observation skills
    - noting and reflecting skills
    - providing client feedback
- Perform specialized counseling interviewing skills, including:
    - challenging
    - reframing
    - focusing
- Perform integrated clear case note taking into the interview process

## 0714E&A63. Apply Specialist Interpersonal and Counselling Interview Skills

**Overview :**

This unit describes the skills and knowledge required to communicate effectively, Use specialized counseling interviewing skills and use advanced and specialized communication skills in the client-counselor relationship. This unit applies to individuals whose job role involves working with clients on personal and psychological issues within established policies, procedures and guidelines.

| Unit of Competency | **Performance Criteria** |
|---|---|
| **CU1.** Communicate effectively | P1 Identify communication barriers and use strategies to overcome these barriers in the client-counselor relationship<br>P2 Facilitate the client-counselor relationship through selection and use of micro skills<br>P3 Integrate the principles of effective communication into work practices<br>P4 Observe and respond to non-verbal communication cues<br>P5 Consider and respond to the impacts of different communication techniques on the client-counselor relationship in the context of individual clients<br>P6 Integrate case note taking with minimum distraction |
| **CU2.** Use specialized counseling interviewing skills | P1 Select and use communication skills according to the sequence of a counseling interview<br>P2 Identify points at which specialized counseling interviewing skills are appropriate for inclusion<br>P3 Use specialized counseling communication techniques based on their impacts and potential to enhance client development and growth<br>P4 Identify and respond appropriately to strong client emotional reactions |

| | |
|---|---|
| **CU3.** Evaluate own communication | P1 Reflect on and evaluate own communication with clients<br>P2 Recognize the effect of own values and beliefs on communication with clients<br>P3 Identify and respond to the need for development of own skills and knowledge |

Knowledge and 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**:**

- Legal and ethical considerations for communication in counseling practice, and how these are applied in individual practice**:**
- codes of conduct/practice
- discrimination
- duty of care
- human rights
- practitioner/client boundaries
- privacy, confidentiality and disclosure
- rights and responsibilities of workers, employers and clients
- work role boundaries responsibilities and limitations of the counselor role
- work health and safety
- principles of person-centered practice
- key objectives of counseling interviewing
- stages of a counseling interview

- potential impacts of using different communication skills and techniques in counseling contexts
- communication techniques and micro-skills including**:**
- attending behaviors active listening, reflection of content feeling, summarizing
- questioning skills open, closed, simple and compound questions
- client observation skills
- noting and reflecting skills
- providing client feedback
- specialized counseling communication techniques, and how they are used, including**:**
- challenging
- reframing
- focusing
- components of the communication process including**:**
- encoder
- decoder
- primary factors that impact on the communication process including**:**
- context
- participants
- rules
- messages
- channels
- noise
- feedback
- communication barriers and resolution strategies, including**:**
- environmental
- physical
- individual perceptions
- cultural issues
- language
- age issues
- disability
- observational techniques including**:**
- facial expressions
- non-verbal behavior

- posture
- silence
- ways in which different people absorb information, including:
- visual
- auditory
- kinesthetic
- obstacles to the counseling process
- impacts of trauma and stress on the communication process, including on:
- concentration and attention
- memory
- use of verbal and written language
- use of body language
- challenging within the counseling session
- self-evaluation practices, including:
- how to recognize own biases
- Impact of own values on the counseling relationship

**Critical Evidence(s) Required**

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

:

A person who demonstrates competency in this unit must be able to provide evidence of the ability to apply specialist interpersonal and counseling interview skills. The evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

Performance Requirements

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Demonstrated evidence is required of the ability to:

- interviewed at least 3 different clients using specialized interpersonal communication and counseling interviewing skills, including:
- micro-skills and communication techniques, including:
  - attending behaviors active listening,

- reflection of content, summarizing
- questioning skills open, closed, simple and compound questions
- client observation skills
- noting and reflecting skills
- providing client feedback

- specialized counseling interviewing skills, including**:**
  - challenging
  - reframing
  - focusing
- integrated clear case note taking into the interview process
- Completed a structured process of self-reflection and evaluation of own communication used during the 3 interviews.

***Electrical & Electronic Measuring Instruments***

**0714E&A64- Operate the Measuring Instruments**

**Overview:** After completion of this competency standard the student will be skilled in electrical and electronic measuring instruments/equipment/devices.

| Competency Units | Performance Criteria |
|---|---|
| **CU1. Identify the measuring instrument** | P1. Identify the instrument.<br>P2. Classify the instrument type. (Analog / Digital)<br>P3. Read measuring units/parameters of the instrument. |
| **CU2. Disassemble / Assemble the Instruments** | P1. Use standard tools to disassemble / assemble the instrument.<br>P2. Apply disassembling techniques<br>P3. Identify and label the parts/components/wires of instruments.<br>P4. Apply assembling techniques.<br>P5. Check for the proper working / functionality of instrument |
| **CU3. Disassemble/ Assemble the moving iron type instrument** | P1. Use standard tools to disassemble / assemble the Moving iron type instrument.<br>P2. Apply disassembling techniques<br>P3. Identify and label the parts/components/wires of moving iron type instruments.<br>P4. Apply assembling techniques.<br>P5. Check for the proper working / functionality of moving iron type instrument |
| **CU4. Operate the Analog measuring instruments** | P1. Identify the type of quantity to be measures.<br>P2. Identify the relevant measuring instrument.<br>P3. Connect the instrument according to the prescribed method.<br>P4. Apply the procedure for reading the value on the display<br>P5. Apply the Megger meter for continuity and insulation.<br>P6. Use Ampere meter, Watt meter, Voltage meter, Lux Meter, Energy Meter, Ohm Meter for various analog measurements<br>P7. Use the Power factor meter for power factor of loads in AC circuits. |
| **CU5. Use the digital measuring instruments** | P1. Identify the type of quantity to be measures.<br>P2. Identify the relevant measuring instrument.<br>P3. Connect the instrument according to the prescribed method.<br>P4. Apply the procedure for reading the value on the display<br>P5. Digital Power factor meter for power factor of loads in AC circuits. |
| **CU6. Operate the** | P1. Identify parts and controls of oscilloscope. |

| | |
|---|---|
| **Oscilloscope and function generator (time based circuit)** | P2. Adjust screen resolution and calibrate screen with probes.<br>P3. Design a time variant circuit using IC for oscilloscope.<br>P4. Design a time variant DC square wave circuit using IC for oscilloscope.<br>P5. Measure the AC/DC signal on oscilloscope using function generator. |
| **CU7. Test & Measure the active & passive components** | P6. Identify the components<br>P7. Classify the component according to power, tolerance accuracy & linearity<br>P8. Check the component.<br>P9. Inspect the component parameters on work bench |

**Knowledge and understanding**

- Define absolute and secondary instruments.
- Define the component parameter, ratings and application.
- Define the documented data for specific component.
- Define the laws of electric circuits.
- Define the physical parameter due to various forces (heating , magnetic electronic)
- Describe assembling & disassembling techniques
- Describe reading and measuring techniques for the circuit through oscilloscope/function generator.
- Describe test and measuring techniques of various meters like ohm meter, ampere meter, lux meter, energy meter, power meter, power factor meter, frequency meter, energy meter etc.
- Describe the instrument's functional parameter.
- Explain different categories of instruments w.r.t working principle.
- Explain Electrical/ electronic symbols
- Explain indicating, integrating and recording instruments.
- Explain laws of electro magnetism.
- Explain Tagging techniques of connections
- Explain Testing techniques of circuit.
- Explain the control knobs for electrical /electronic signals.
- Explain the instrument measurement principle from time and amplitude screen.
- Explain the procedure/ method of testing the given component.
- Explain the various parts and components of the instrument.
- Operating principle of analog and digital instruments.

**Tools & Equipment**

| SN | |
|---|---|
| **1.** | Analog meter |
| **2.** | DMM |
| **3.** | Electrical test bench |
| **4.** | Hand glove |
| **5.** | Lux meter |
| **6.** | Manual tools |
| **7.** | Multimeter |

| | |
|---|---|
| **8.** | Nose pliers |
| **9.** | Oscilloscope• |
| **10.** | Power source (AC/DC) |
| **11.** | Screw drivers |
| **12.** | Static hand gloves |
| **13.** | Tagging marks |
| **14.** | Test probes |
| **15.** | Thermometer |
| **16.** | Twizer |
| **17.** | Watt meter |
| **18.** | Wire Cutter |

## Critical Evidence(s) Required

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

Evidence of the following is essential:

- Basic Measuring of Construct Op amp
- Use op amp as integrator

***Instrumentation Workshop Practice***

**0714E&A65- Connect Tubing and Fittings**

**Overview:**
After this competency standard the student will be able to select appropriate device or equipment, Obtain measurements using a range of measuring devices.

| Competency Units | Performance Criteria |
|---|---|
| **CU1. Measure the parameters using different instruments** | P1. Determine measurement requirements from specifications.<br>P2. Select appropriate instrument for the measurement<br>P3. Apply correct measuring techniques as required.<br>P4. Record the measurements as per requirements.<br>P5. Generate an output report. |
| **CU2. Use the Hand & Power Tools** | P1. Select the appropriate hand/power tool.<br>P2. Use hand/power tools to achieve desired outcome<br>P3. Identify the unsafe & faulty tools and forward them for repair<br>P4. Store hand tools safely in appropriate location as per organizational SOPs<br>P5. Perform adjustment/ alignments over a range of Hand/ power tools.<br>P6. Sharpen the hand/power tools using appropriate techniques. |
| **CU3. Prepare the tubes for operations** | P1. Gather materials, required for the work.<br>P2. Select tools, equipment and testing devices required for operation.<br>P3. Check the workability of tools.<br>P4. Perform calculations for bends and radius. |
| **CU4. Attach Fittings to the tubing** | P1. Perform following operations to prepare the tube for installation.<br>Cut, flare, swage, bend, braze<br>P2. Attach the tubing as per the circuit diagram.<br>P3. Perform the Test Run on Equipment<br>P4. Check for leakages & rectify where applicable. |

**Knowledge and understanding**

- Define the Clamping /securing methods
- Define the procedures of Piping, Cutting, Bending, Joining, Soldering and brazing
- Define the solder types
- Define the zeroing techniques measuring instruments
- Define types of tubes.

- Describe applications of a range of measuring instruments
- Describe faults and defects in hand and power tools
- Explain applications of different hand and power tools in a general engineering context
- Explain benefits and limits of cutting and shaping metal with auxiliary equipment
- Explain measuring techniques for different parameters.
- Explain Procedures for marking unsafe or faulty tools for repair
- Explain soldering techniques
- Explain steps for tube Cutting, Bending & Joining
- Explain the safe handling and storing a range of measuring instruments
- Explain the Soldering and brazing equipment, Process & gas types.

**Tools & Equipment**

| SN | |
|---|---|
| **1.** | Combination squares |
| **2.** | Depth gauge meter etc |
| **3.** | Dial indicators |
| **4.** | Digital Vernier Caliper |
| **5.** | Flaring Tool |
| **6.** | Micrometer |
| **7.** | Protractors |
| **8.** | Set squares |
| **9.** | Soldering & brazing equipment |
| **10.** | Steel rule |
| **11.** | Swaging tools |
| **12.** | Tapes |
| **13.** | Tube benders for different diameter. |
| **14.** | Tube cutter |
| **15.** | Vernier Calliper |

**Critical Evidence(s) Required**

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

Evidence of the following is essential:

- Perform soldering
- Perform the test run on equipment

## 0714E&A66- Perform Basic Machining Operations

**Overview:**
After this competency standard the student will be able to prepare material and perform machining operations of drilling, Lathe and Grinding.

| Competency Units | Performance Criteria |
|---|---|
| **CU1. Prepare material & machine for operations** | P1. Sketch & interpret the mechanical drawings<br>P2. Select materials according to the specifications.<br>P3. Mark & center punch the work piece<br>P4. Select the appropriate machine for operation<br>P5. Set speed and feed on the machine.<br>P6. Check the workability of machine and its tools & accessories.<br>P7. Perform a test run on the machine |
| **CU2. Operate the Drilling machine** | P1. Select the suitable Drill bit for operation<br>P2. Perform drilling operation as per operations manual of machine<br>P3. Perform counter sinking/ counter Boring<br>P4. Perform Reaming operation.<br>P5. Perform post-operative measures on the machine and work piece. |
| **CU3. Perform Grinding operations** | P1. Select the suitable Grinding wheel for operation<br>P2. Perform Grinding operation as per operations manual of machine<br>P3. Perform operations for checking the surface finish<br>P4. Perform post-operative measures on the machine and work piece. |
| **CU4. Operate the Lathe machine** | P1. Select the suitable turning/boring tools for operation<br>P2. Perform Turning operation as per operations manual of machine<br>P3. Perform Facing operation as per operations manual of machine<br>P4. Perform Drilling/Boring operation as per operations manual of machine<br>P5. Perform Reaming operation.<br>P5. Perform post-operative measures on the machine and work piece. |

**Knowledge and understanding**

- Define the work holding devices.
- Describe working principles of Grinding machines
- Explain drawing to mark the work piece
- Explain the drill bits, Speed and feed for different materials
- Explain the need for counter sinking/ counter boring operations
- Explain the need for reaming operations
- Explain the offhand grinding
- Explain the securing techniques of work pieces
- Explain the surface finish, fits and tolerance

- Explain working principles and use of drilling machine
- Explain working principles of Lathe machine for different operations

**Tools & Equipment**

| SN | |
|---|---|
| **1.** | Bench drilling machine |
| **2.** | Drill bits & Reamers |
| **3.** | Engine Lathe |
| **4.** | Grinding Accessories |
| **5.** | Grinding wheels |
| **6.** | Hand Drilling machine |
| **7.** | Lathe machine ,accessories and tools |
| **8.** | Marking table |
| **9.** | Measuring & marking tools |
| **10.** | Milling Machine and accessories |
| **11.** | Pedestal drilling machine |
| **12.** | Safety gear |
| **13.** | Surface & Cylindrical grinding machines with accessories |
| **14.** | Tool Lathe |
| **15.** | Turning Tools |
| **16.** | Wheel balancing & dressing attachment |
| **17.** | Work holding devices Hand tools |

**Critical Evidence(s) Required**

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

Evidence of the following is essential:

- Operate Lathe Machine
- Operate Drill Machine

***Electrical Circuit Analysis***

## 0714E&A67- Apply Fundamental DC Laws in Electric circuits

**Overview**

After this competency standard the student will be able to identify & Study the characteristics of a variety of circuits related to DC Fundamentals and their usage in industry.

| Competency Units | Performance Criteria |
|---|---|
| **CU1. Test different circuits by using Ohm's Law** | P1. Identify the Resistor and its type<br>P2. Calculate the resistance of available resistors via Color coding chart<br>P3. Draw the different circuits with the aid of Resistors.<br>(Series Circuits, Parallel Circuits, Series-Parallel Circuits)<br>P4. Interface the resistor with led for understanding the concept of Ohm's Law.<br>P5. Connect voltmeter, ammeter and wattmeter in Resistors based circuits for calculations of parameters(Voltage, Current and Power) |
| **CU2. Implement the DC Network theorems** | P1. Apply Kirchoff's Current Law on circuits for developing the concept effectively.<br>P2. Apply Kirchoff's Voltage Law on circuits for developing the concept effectively.<br>P3. Apply superposition theorem on circuits for developing the concept effectively.<br>P4. Apply maximum power transfer theorem on circuits for developing the concept effectively.<br>P5. Apply thevenin's theorem on circuits for developing the concept effectively.<br>P6. Apply Norton's theorem on circuits for developing the concept effectively.<br>P6. Apply Mesh theorem on circuits for developing the concept effectively.<br>P7. Apply Star Delta and Delta Star Transformations of circuits. |
| **CU3. Estimate the Power and Energy** | P1. Connect wattmeter for measuring power in series and parallel circuits<br>P2. Implement formulas for finding power and energy theoretically.<br>P3. Perform a task for calculation of usage power and energy<br>P4. Analyze the mechanical power by performing the practical with motors. |
| **CU4. Perform series and parallel connection of capacitors in circuits** | P1. Classify the capacitor and its types<br>P2. Use capacitor in different circuits for understanding the functional area of capacitor<br>P3. Capacitor in series and parallel circuits<br>P3. Calculations of capacitor based circuits theoretically and practically.<br>P4. Calculate charging and discharging waveforms by using digital oscilloscope |

**Knowledge and understanding**

- Understand multi-meter & power Supply
- Understand Resistor and its types
- Understand the capacitors and its types
- Understand the Color code chart of Resistor
- Understand the data manual
- Understand the KVL, KCL, superposition theorem, maximum power transfer theorem, thevenin's theorem, Norton's theorem, Mesh theorem, star delta and delta star transformations.
- Understand the power(electrical and mechanical) and energy
- Understand the procedures for implementation of theorems on circuits

**Tools & Equipment**

| SN | |
|---|---|
| **1.** | Multi-meter |
| **2.** | Power supply. |
| **3.** | Digital Trainer |
| **4.** | Digital Oscilloscope |
| **5.** | Trainer |
| **6.** | Power Meter |

**Critical Evidence(s) Required**

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

Evidence of the following is essential:

- Calculate charging and discharging of capacitor waveform by oscilloscope
- Apply KVL and KCL on a circuit

## 0714E&A68- Apply Fundamental AC Laws in Electric Circuits

**Overview**

After this competency standard the student will be able to identify variety of circuits related to AC Fundamentals and their usage in industry.

| Competency Units | Performance Criteria |
|---|---|
| **CU1. Calculate the Alternating Current and Voltage** | P1. Perform a task on electric board or three phase panel via multi-meter and oscilloscope for measuring Alternating Current, voltage, frequency, amplitude, RMS value, Average value, Peak value and phase difference.<br>P2. Identify the AC and DC Generators.<br>P3. Record the AC signal on oscilloscope |
| **CU2. Measure the parameters in an AC circuit** | P1. Perform a task with AC loads (resistive, capacitive and inductive).<br>P2. Calculate the AC parameters (Impedance, Phase Difference, and Phase Angle).<br>P3. Perform a task for measuring RLC Series and Parallel circuits with AC source.<br>P4. Perform a task for demonstration of Resonance in series and parallel circuits. |

**Knowledge and understanding**

- Understand Alternating Current and Voltage.
- Understand the principle working of AC and DC generator and their applications.
- Understand AC Circuits (resistive, capacitive and inductive).
- Understand multi-meter, sequence tester, merger & power Supply.

**Tools & Equipment**

| SN | |
|---|---|
| | Digital Oscilloscope |
| | Megger |
| | Multi-meter |
| | Phase sequence tester |
| | Power supply |
| | Trainer |

**Critical Evidence(s) Required**

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

Evidence of the following is essential:

- Draw AC Current waveform

***Instrumentation Drawing***

**0714E&A69- Use Engineering drawing techniques to produce Instrumentation Drawings**

**Overview:**

This competency standard identifies the Use of engineering drawings including Process Flow Diagrams (PFDs), Piping and Instrument Diagrams (P&IDs), process equipment datasheets, vendor equipment engineering drawings and/or layouts and equipment datasheets, to support operations, maintenance and engineering activities.

| Competency Units | Performance Criteria |
|---|---|
| **CU1. Prepare to use instrumentation drawings, specifications and standards.** | P1. Identify Basic engineering drawings and symbols.<br>P2. Identify the use of Process Flow Diagrams (PFDs)<br>P3. Identify the use of Process Engineering Flow Schemes (PEFSs).<br>P4. Identify the Methods of using Piping and Instrumentation Diagrams (P&IDs).<br>P5. Identify the Methods of reading equipment datasheets. |
| **CU2. Identify and draw Process Flow Sheet Symbol** | P1. Identify, draw and label the symbols of process line, valves and actuator with and without positioner or other pilot.<br>P2. Identify, draw and label the symbols of Furnace, boiler, Heat transfer and Heat Exchanger<br>P3. Identify, draw and label the symbols of Pump and compressor.<br>P4. Identify, draw and label the symbols of Drivers.<br>P5. Identify, draw and label the symbols of Process pressure vessels and Dryers.<br>P6. Identify, draw and label the symbols of Material handling equipment and Size reducing equipment.<br>P7. Identify, draw and label the symbols of Process Equipment. |
| **CU3. Identify and draw Flow Sheet and Line Symbols** | P1. Identify, draw and label the symbols Flow sheet code letter service (letter A to letter V).<br>P2. Identify, draw and label the symbols for Lines.<br>P3. Identify, draw and label of the Utility symbols.<br>P4. Identify, draw and label Process and utility flow sheet for drives. |
| **CU4. Identify and draw Instrument Symbol.** | P1. Identify Instrument identification or tag number (6 letter code), Identification of letter (A to Z) and Instrument line symbols (Instrument supply, undefined signal, Pneumatic signal etc.).<br>P2. Identify, draw and label the Symbols of |

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| | different electronics RCL/PLC based control system.<br>P3. Identify, draw and label the Symbols for Flow, Level, Pressure and Temperature gauges and transmitters. |
| **CU5. Identify and draw Logic Function , PLC and Distributed Control Display Symbols** | P1. Identify, draw and label Logical function symbols such as Gates.<br>P2. Identify, draw and label Transmission and Switching symbols.<br>P3. Identify, draw and label Timer, Switching symbols for PLC, Push buttons and different kinds of instrument switches.<br>P4. Identify, draw and label the symbols of Output device.<br>P5. Identify, draw and label the Distributed control / shared display symbols( As per ISA), Distributed control Computer symbols, Distributed control logic/sequential Control symbols, Miscellaneous symbols such as Computing/signal conditioning and software system link. |
| **CU6. Identify and draw Piping and Fluid Power Symbols.** | P1. Identify, draw and label the Piping symbols.<br>P2. Identify, draw and label the Flow Obstruction symbols.<br>P3. Identify, draw and label the Fluid power symbols.<br>P4. Identify, draw and label the symbols of Heater, Cooler, Temperature controller, filter strainer and drainers.<br>P5. Identify, draw and label the symbols of Hydraulic and pneumatic components.<br>P6. Identify, draw and label the symbols of Actuator and control valves. |
| **CU7. Create instrumentation drawings using application software.** | P1. Create Basic Diagram such as Circular Diagram, Venn diagram, Pyramid Diagram, List Diagram, Arrow Diagram, Circle Spoke Diagram, and Timeline using CAD software.<br>P2. Create Charts and Graphs using CAD software.<br>P3. Create different kinds of Flowchart and Workflow Diagram using CAD software.<br>P4. Create Engineering Diagram on CAD software.<br>P5. Create Industrial Control System Diagram/Schematic. |
| **CU8. Implement the instrumentation drawings, specification and standard.** | P1. Create neat freehand instrumentation drawing.<br>P2. Draw Instrumentation drawings, specification, standards on cad software such as Electrical CAD software.<br>P3. Interpret Instrumentation drawings using knowledge of process controls and instrumentation drawing layouts, conventions and symbols.<br>P4. Identify and Extract the Dimensions from the |

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| | instrument drawings and diagrams.<br>P5. Determined the Location of equipment from the given instrumentation drawings and specification.<br>P6. Identify the Connections between pneumatic, hydraulic and electrical equipment are determined from instrumentation drawings and specifications. |
| **CU9. Validate engineering drawings.** | P1. Identify the Methods of developing engineering drawing documents.<br>P2. Identify the Methods of maintaining documentation<br>P3. Identify the Methods of evaluating engineering drawing techniques. |

**Knowledge and understanding**

- Explain the basics of creating basic instrument drawing, flow chart and symbolic diagrams using CAD application software such as Lucid chart, PROCAD, Edraw Max, Smart Draw, Microsoft Visio.
- Knowledge and understanding of Basic Flow Sheet and Line Symbols.
- Knowledge and understanding of Basic Instrument Symbol.
- Knowledge and understanding of Basic Piping and Fluid Power Symbols.
- Knowledge and understanding of Basic Process Flow Sheet Symbols.
- Knowledge and understanding of Basic Logic Function , PLC and Distributed Control Display Symbols
- Knowledge and understanding of critical reviews of engineering drawings and designs.
- Knowledge and understanding of location, dimension and connection inside the instrument drawing.
- Knowledge and understanding of operations and maintenance troubleshooting and fault-finding activities.
- Knowledge of creating freehand instrument drawing.
- Knowledge of creating instrument drawing using CAD application software.
- Knowledge of editing and interpreting instrument drawing.
- Read and interpret PFDs
- Understand to Locate and select correct drawings for units or systems.

**Tools & Equipment**

Pencil, drafting board, T-square, drafting machine, French Curves, Rulers, Compass, Templates, Perspective machines, drawing materials, drafting paper, Thick draft paper, Cloth, tracing paper, Tracing tube, Inks, Dry transfer
Computers with enhanced graphic card & 20-inch Display, Electrical CAD software such as

Lucid chart, Edraw PROCAD, Max, Smart Draw, Microsoft Visio etc.
Plotter/printer.

## Critical Evidence(s) Required

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

Evidence of the following is essential:

- Identify various tools for engineering drawing.
- Identify different symbol of instrumentation drawing

***Instruments Servicing & Calibration (IT-353)***

**0714E&A70- Calibrate the Measuring Instruments**

**Overview:**

After completion of this competency standard the student will be able to perform Calibration of Measuring Instruments/equipment/devices.

| Competency Units | Performance Criteria |
|---|---|
| **CU1. Perform the test run** | P1. Check the device physically.<br>P2. Check the device with multi-meter.<br>P3. Connect device with power source (if applicable).<br>P4. Perform test run as described in the procedure<br>P5. Note parameters of the device. |
| **CU2. Dismantle the device** | P1. Use standard tools described in user manual<br>P2. Perform isolation of devices(if applicable)<br>P3. Apply disassembling & assembling techniques<br>P4. Tag the wires of device. |
| **CU3. Diagnose the fault in device** | P1. Inspect physical condition of device<br>P2. Check the operating panel of the device<br>P3. Check for electrical faults<br>P4. Check mechanical fault & check pneumatic sensors<br>P5. Inspect the hardware visually for any damage or unusual orientation<br>P6. Tag the faulty component |
| **CU4. Repair the sensing device** | P1. Draw Block Diagram of sensor board & connections<br>P2. Identify the construction and working of electrical interface<br>P3. Fix the fault in sensor interface.<br>P4. Fix the fault in operator panel<br>P5. Fix the fault in power section.<br>P6. Fix the fault in display circuit.<br>P7. Fix the fault in beeper<br>P8. Fix the fault in recording unit<br>P9. Perform test run |
| **CU5. Calibrate &repair the gauges (pneumatic/ electronic)** | P1. Check the gauge physically.<br>P2. Check with multi-meter.<br>P3. Apply standard pressure or connect device with power source (if applicable).<br>P4. Perform test run as described in the procedure.<br>P5. Note parameters of the device. |
| **CU6. Calibrate the thermocouple and temperature Sensor (RTD)** | P1. Check the thermocouple physically.<br>P2. Check with multi-meter.<br>P3. Apply standard temperature and connect device with power source (if applicable).<br>P4. Perform standardized test as described in the procedure.<br>P5. Note parameters of the thermal sensor. |

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| **CU7. Calibrate the magnetic level switch** | P1. Check the magnetic level switch physically.<br>P2. Check with compass/ magnet.<br>P3. Submerge the switch in the tank and observe the state of the contact (via multi-meter).<br>P4. Perform standardized test as described in the procedure.<br>P5. Note parameters of the magnetic level switch. |
| **CU8. Calibrate the control valve &valve positioner** | P1. Check the control valve and its positioner physically.<br>P2. Check the valve with power source and multi-meter.<br>P3. Check the state of the valve for its normal operation.<br>P4. Check the state of the valve for its positioning (x-axis, y-axis z-axis) by applying valve positioner.<br>P5. Perform standardized test as described in the procedure.<br>P6. Note the operating range of the valve for its optimum operation. |
| **CU9. Calibrate the electromagnetic type flow meter** | P1. Check the electromagnetic flow meter physically.<br>P2. Check the electromagnetic flow meter by applying power (using multi-meter).<br>P3. Check the state of the electromagnetic flow meter's sensor's normal operation.<br>P4. Check the state of the sensor across the specimen.<br>P5. Perform standardized test as described in the procedure<br>P6. Note the operating range of the flow meter for its optimum operation. |
| **CU10. Calibrate pH meter** | P1. Check the pH meter physically.<br>P2. Check the pH meter by applying power (using multi-meter).<br>P3. Check the state of the pH meter's sensor's normal operation.<br>P4. Check the state of the sensor across the buffers/specimen.<br>P5. Perform standardized test as described in the procedure<br>P6. Note the operating range of the pH meter for its optimum operation |
| **CU11. Prepare the Graphs, comparison/ conversion table** | P1. Make arrangement of data as per standard measurement. (for various ranges)<br>P2. Develop a graph according to need (dependent/ independent variable)<br>P3. Select the unit conversion and calculation to make legends.<br>P4. Mark the ranges and parameters of the data for graphs.<br>P5. Mark the origin of the graph for plotting the meaning full result. |

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|---|---|
| | P6. Conclude the result from the plotted graph. |

**Knowledge and understanding**

- Describe assembling & disassembling techniques
- Describe characteristics of electrical / electronic components
- Describe control valve & valve positioner operation faults
- Describe Display: LCD, LED, Niddle, indicating instrument
- Describe electromagnetic flow meter control valve operation and common faults
- Describe functions of analog electronics blocks
- Describe functions of digital electronics blocks
- Describe magnetic level switch operation faults
- Describe multi-meter.
- Describe operation of pH meter and its common faults
- Describe sensor and their various types
- Describe the accuracy of thermo couple and RTD.
- Describe the applications of thermocouple and RTD.
- Describe the parameters.
- Describe the sensor type and operation.
- Describe the temperature range of various RTD and temperature sensors.
- Describe the testing method of control valve & valve positioner.
- Describe the testing method of flow meter.
- Describe the testing method of magnetic level switch.
- Describe the testing method of pH meter.
- Describe the types of control valve & valve positioner w.r.t its capacity (flow)
- Describe the types of flow meter w.r.t its capacity (flow)
- Describe the types of magnetic level switch w.r.t its capacity (depth)
- Describe the types of pH meter w.r.t its sensor and ranges (acid and base).
- Describe the working of differential pressure switch.
- Describe the working principles of different gauges like C type pressure gauge and vacuum gauge
- Describe working principles of thermocouple and temperature sensor RTD,K,PT-100,J,R,S
- Electrical / electronic components faults
- Electronics
- Elementary physics
- Engineering mathematics
- Explain basic types of gauges.
- Explain data recording function.
- Explain Electrical/ electronic & functional -drawing symbols
- Explain fault diagnosis techniques
- Explain information getting procedure of device.
- Explain operation of control valve & valve positioner
- Explain operation of flow meter sensor.
- Explain operation of magnetic level switch
- Explain operation of pH meter sensor.
- Explain operator panel and its switch functions.
- Explain power and signal conditioning
- Explain sound signal
- Explain Tagging techniques of connections
- Explain the Layout drawings

- Explain the Tagging of wire & components
- Explain types and materials of thermocouple, and temperature sensor (RTD same)
- Explain Types and structure & parts of sensors/electrode
- Explain types and structure of control valve.
- Explain types and structure of magnetic level switch.
- Explain working principle of flow meter and law of electro magnetism.
- Explain working principle of magnetic level switch.
- Explain working principle of pH meter and definition of pH with laws.
- Explain working principle of control valve & valve positioner.
- Geometry.
- Understand new operating procedures and constraints

**Critical Evidence(s) Required**

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

Evidence of the following is essential:

- Carryout Calibration of various gauges
- Diagnose the fault in different devices

## 0714E&A71- Install the boiler control system

**Overview:**

After this competency standard the candidate will be able to implement, troubleshoot and perform maintenance and diagnostics of boiler instruments and its control system in various industries.

| Competency Units | Performance Criteria | |
|---|---|---|
| **Cu1. Calibration of differential Pressure transmitter (Electronics)** | PC1. Give input pressure of<br>% age input output DC<br>PC2. 0%, ---------- 4 mA<br>PC3. 25% ---------- 8 mA<br>PC4. 50% ---------- 12 mA<br>PC5. 75% ---------- 16 mA<br>PC6. 100% ---------- 20 mA | Dc Power supply<br>Multimeter<br>Screw driver set<br>Screw spanner<br>Calibrator for input pressure |
| **Cu1. Calibration of differential Pressure transmitter (pneumatics )** | PC1. Give input pressure of<br>% age input output<br>PSI Kg/cm2<br>PC2. 0% ------ 3 0.2<br>PC3. 25% ------ 6 0.4<br>PC4. 50% ------ 9 0.6<br>PC5. 75% ------ 12 0.9<br>PC6. 100% ------ 15 1.0 | screw driver set<br>screw spanner<br>calibrator for input pressure<br>output (gauges, manometers) |
| **Cu3. Calibration of differential Pressure transmitter with Hart Communicator (475 Rose Mount)** | PC1. Give input pressure of<br>% age input output DC<br>PC2. 0%, ---------- 4 mA<br>PC3. 25% ---------- 8 mA<br>PC4. 50% ---------- 12 mA<br>PC5. 75% ---------- 16 mA<br>PC6. 100% ---------- 20 mA | Dc Power supply<br>Multimeter<br>Screw driver set<br>Screw spanner<br>Calibrator for input pressure<br>Hart Communicator (475 Rose Mount)<br>Precision resistor of 250 ohm |
| **CU4. Calibration of Temperature transmitter** | % / C o / I/P thermocouple / O/P mA DC<br>0 / / / 4<br>25 / / / 8<br>50 / / / 12 | screw driver set<br>Decade box (Resistance box)<br>DC power |

| | | | | | |
|---|---|---|---|---|---|
| | 75 | | | 16 | supply<br>Multimeter<br>Milliampere source<br>Thermocouple Table |
| | 100 | | | 20 | |
| | % | Co | I/P RTD (Pt-100) ohms | O/P mA DC | |
| | 0 | | | 4 | |
| | 25 | | | 8 | |
| | 50 | | | 12 | |
| | 75 | | | 16 | |
| | 100 | | | 20 | |
| **Calibration of Pressure Switch** | % | | Input pressure | output | Screw driver set<br>Multimeter<br>Input pressure |
| | 0 | | | continuity | |
| | 25 | | | | |
| | 50 | | | | |
| | 75 | | | | |
| | 100 | | | | |
| | | | | | |
| | | | | | |

***Knowledge & Understanding***

*Working principal pressure transducer, working of transmitter*

**Tools and equipment's**

| | |
|---|---|
| **1** | **Dc Power supply** |
| **2** | Multimeter |
| **3** | Screw driver set |
| **4** | Screw spanner |
| **5** | Calibrator for input pressure |
| **6** | Install and calibrate the transmitter |

**Critical Evidence(s) Required**

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

Evidence of the following is essential:

Calibration of differential Pressure transmitter (pneumatics )

***Sensor & Transducers***

**0714E&A72- Interface the Sensors & Transducers**

**Overview:** After completion of this competency standard the student will be skilled in interfacing sensors and transducers with instruments/equipment/devices.

| Competency Units | Performance Criteria |
|---|---|
| **CU1. Connect the sensors and transducers in circuits** | P1. Classify the sensor /transducer types.<br>P2. Check the I/O relationship, Active & Passive.<br>P3. Identify working type & principal of construction of sensors/ transducer.<br>P4. Connect the sensors/ transducer<br>P5. Use measuring instrument for testing sensors/ transducer.<br>P6. Observe the sensors/ transducer from lower to higher limits to avoid burnout.<br>P7. Plot a graph between input and observed output data.<br>P8. Compare the output with standard data. |
| **CU2. Assemble thermal sensors/ transducers** | P1. Classify the type sensor /transducer &the I/O relationship (active/Passive).<br>P2. Assemble sensors/ transducer with interface.<br>P3. Identify the type of measuring instrument for observing the lower to higher measuring limits<br>P4. Plot a graph between input and observed output data.<br>P5. Compare the output with standard data. |
| **CU3. Assemble electro-mechanical sensors/ transducers** | P1. Classify the type sensor /transducer &the I/O relationship (active/Passive).<br>P2. Assemble sensors/ transducer with insulation to interface.<br>P3. Identify movable/function part to perform electromagnetic operation using power within limit<br>P4. Identify the type of displacement as per orientation.<br>P5. Plot a graph between input and observed output data.<br>P6. Compare the output with standard data. |
| **CU4. Assemble opto electronic sensors/ transducers** | P1. Classify the type sensor /transducer & the I/O relationship<br>P2. Assemble sensors/ transducer with maximum reception.<br>P3. Identify the optical part to obtain electro-optical signal reception / coupling.<br>P4. Identify the structural orientation of the sensor and transducer.<br>P5. Plot a graph between input and observed output data.<br>P6. Compare the output with standard data. |

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| **CU5. Assemble digital/ electronic sensors/ transducers** | P1. Classify the type sensor /transducer &the I/O relationship<br>P2. Assemble sensors/ transducer as per specification.<br>P3. Bias the sensor with power source to obtain the signal output.<br>P4. Identify the mode of output from sensor and transducer.<br>P5. Plot a graph between input and observed output data.<br>P6. Compare the output with standard data. |
| **CU6. Couple & Decouple the sensors/ transducers** | P1. Use standard tools described in user manual<br>P2. Perform isolation of sensors/ transducers.<br>P3. Apply disassembling techniques<br>P4. Identify and tag the parts/components/ wires of sensors/ transducers & instruments.<br>P5. Apply assembling techniques.<br>P6. Check for the proper operation/ functionality |

**Knowledge and understanding**

- Define conductivity, laws of electromagnetism, Lorentz's force, LVDT, solenoid and gauges.
- Define laws of electricity/electronics, A/D converter, D/A converter, sensitivity, gain bandwidth relationship, FM/AM modulation, semiconductor sensors, digital IC sensor transducers.
- Define opto electronic, photo electric effect, gain bandwidth relationship laws of optics, photo sensors/ transducers.
- Define the digital sensors/ transducer with respect to milli volt output and output wave form.
- Define the electro-mechanical sensors/transducer w.r.t moving part and electro-induction parts/element.
- Define the electronic sensors/transducer
- Define the operating principle of active sensors /transducer.
- Define the opto electronic sensors/transducer w.r.t coupling.
- Define the sensors/transducer & sensing element.
- Define the sensors/transducer parameter due to various forces
- Define thermal conductivity, temperature coefficient, specific heat, and thermodynamics.
- Define wiring diagram for opto electronic sensors/transducer.
- Define wiring diagram for sensors/transducer.
- Describe assembling & disassembling techniques
- Describe the sensors/ transducers& instrument's function.
- Explain different categories of sensors/ transducer with respect to application.
- Explain different categories of thermal sensors/ transducer.
- Explain different digital & electronic sensors/ transducer.
- Explain different electro-mechanical sensors/ transducer.
- Explain different opto electronic/opto coupler sensors/ transducer.
- Explain Electrical/ electronic sensors/ transducers
- Explain Electrical/ electronic symbols.
  Explain electrical/ electronic/ optical symbols.
- Explain electrical/ electronic/ symbols and physical parameter

- Explain power requirement with wiring diagram for electro-mechanical electronic / solid state sensors/transducer.
- Explain Tagging techniques of connections
- Explain the relationship between physical parameter and gain.
- Explain the relationship of gain verses distance.
- Explain the various parts and elements of the sensors/ transducers.
- Explain wiring diagram for active and passive sensors/transducer.
- Explain wiring diagram for electronic / solid state sensors/transducer.
- Explain working type & principal of construction of sensors /transducer.
- Explain working type principal & construction of digital sensors/transducer.
- Explain working type principal & construction of electro-mechanical sensors/transducer.
- Explain working type principal & construction of electronic sensors/transducer.
- Explain working type principal & construction of opto electronic sensors/transducer.
- Explain working type principal & construction of thermal sensors/transducer.

**Tools & Equipment**

| SN | |
|---|---|
| 1. | Analog meter |
| 2. | Calibrator |
| 3. | Electrical test bench |
| 4. | Electrical test bench |
| 5. | Hand glove |
| 6. | IC tester |
| 7. | LCR meter |
| 8. | Magnet |
| **1.** | Manual tools |
| **2.** | Multi-meter |
| **3.** | Oscilloscope |
| **4.** | Stationary for graph |
| **5.** | Stop watch |
| **6.** | Test probes |
| **7.** | Transistor tester |

**Critical Evidence(s) Required**

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

Evidence of the following is essential:

- Classify the sensor /transducer types.
- Assemble various sensors and transducers

***Semiconductor devices & Electronic Circuits***

## 0714E&A73- Characterize Diodes Application

**Overview**

After completion of this competency standard the student will be able to implement diodes & characterize BJTs, FETs and MOSFETS with the help of DATA sheet

| Competency Units | Performance Criteria |
|---|---|
| **1. Implement Diodes in circuits** | P1. Identify the Diodes<br>P2. Identify its types & polarities<br>P3. Draw Diode characteristic curves in forward and reverse Biased<br>P4. Construct a circuit for Half-wave and Full-wave Rectification.<br>P5. Record the waveforms on Digital oscilloscope |
| **2. Identify parameters of data sheet of BJTs and FETs** | P1. Identify different Codes for data sheets<br>P2. Identify types of data sheets<br>P3. Identify current and voltages on data sheets<br>P4. Identify characteristic curves on data sheets |
| **3. Identify BJTs** | P1. Identify Emitter , Base and Collector Terminals, K1, K2 and gate<br>P2. Types of BJTs<br>P3. Draw Characteristics curves of BJT's. |
| **4. Identify parameters of FETs with the help of data sheet.** | P1. Identify different Codes for FETS data sheets<br>P2. Identify types of data sheet<br>P3. Identify current and voltages on data sheets<br>P4. Identify characteristic curves on data sheets |
| **5. Identify FETs** | P1. Identify Source, Gate and Drain Terminals<br>P2. Types of FETs<br>P3. Draw Characteristics curves of FETs |
| **6. Characterize MOSFET performance.** | P1. Assemble the circuit of MOSFET.<br>P2. Draw the characteristics curve of MOSFET.<br>P3. Differentiate Types of MOSFET.<br>P4. Troubleshoot the MOSFET'S Performance. |

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| **7. Use MOSFET as a Switch.** | P1. Draw the circuit of MOSFET as Switch.<br>P2. Observe the Curve of MOSFET.<br>P3. P3.Troubleshoot MOSFET as a switch.<br>P4. P4.Use MOSFET as a switch. |

**Knowledge and understanding**

- Differentiate between the characteristic curves of various BJTs
- Differentiate between the characteristic curves of various FETs
- Explain the diodes, forward and reverse biasing & their applications in circuits
- Explain the identifier number & international schemes of a BJT
- Japanese system (numbers start with 2S).
- Japanese system (numbers start with 2S).
- Study different types of BJTs
- Study different types of FETs
- Study European Pro-Electron scheme's JEDEC (numbers start with 2N for transistors)
- Study its characteristics curve and parameters.
- Study the international schemes that are widely used:
- Study the circuit of MOSFET as a switch.
- Study the identifier number of a BJT
- Study the operation of MOSFET.
- Understand Multi-meter & power Supply
- Understand the data sheets

**Tools & Equipment**

| **SN** | |
|---|---|
| 1. | BJTs |
| 2. | Bread Board |
| 3. | Different data sheets of BJTs/IGBT |
| 4. | Digital Oscilloscope |
| 5. | Digital Trainer |
| 6. | FETs |
| 7. | Multi-meter |
| 8. | Oscilloscope |
| 9. | Power supply |
| 10. | Vero board |

**Critical Evidence(s) Required**

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

Evidence of the following is essential:

- Working principal of MOSFET and FET
- Draw Characteristics curve of FETS

## 0714E&A74- Characterize Various FET Amplifiers.

**Overview:**
This standard identifies the competencies required to Characterize Various FET amplifier.

| Competency Units | Performance Criteria |
|---|---|
| **CU1. Assemble a CS Amplifier circuit and observe its characteristics** | P1. Draw the circuit of CS Amplifier & measure its parameters.<br>P2. Draw its characteristics curve.<br>P3. Troubleshoot CS Amplifier circuit. |
| **CU2. Assemble a CG Amplifier circuit and observe its characteristics.** | P1. Draw the circuit of CG Amplifier. Measure its parameters.<br>P2. Draw its characteristics curve.<br>P3. Troubleshoot CG Amplifier circuit. |
| **CU3. Assemble a CD Amplifier circuit and observe its characteristics** | P1. Draw the circuit of CD Amplifier. Measure its parameters.<br>P2. Draw its characteristics curve.<br>P3. Troubleshoot CG Amplifier circuit. |
| **CU4. Assemble a single stage Transistor Amplifier.** | P1. Draw the circuit of a single Stage Transistor Amplifier.<br>P2. Measure its parameters.<br>P3. Draw its characteristics curve.<br>P4. Troubleshoot the single stage Transistor amplifier. |
| **CU5. Measure the voltage gains of a single Stage Class 'A' Transistor Amplifier.** | P1. Calculate the input and output voltage of Class A Transistor Amplifier<br>P2. Find out gain by dividing output/input. |
| **CU6. Identify Common Source FET Amplifier.** | P1. Assemble common source Amplifier circuit<br>P2. Apply the use FET amplifier curve.<br>P3. Troubleshoot FET amplifier<br>P4. Repair common source FET amplifier |
| **CU7. Plot the characteristics curve of Common source FET Amplifier.** | P1. Draw the characteristics curve of FET Amplifier.<br>P2. Draw the parameters of characteristics curve. |
| **CU8. Assemble a Class A Transistor Amplifier.** | P1. Draw the circuit of a Class A Transistor Amplifier. Measure its parameters.<br>P2. Draw its characteristics curve.<br>P3. Troubleshoot the Class A Transistor Amplifier. |
| **CU9. Plot Frequency Response of class A Amplifier.** | P1. Calculate the input and output voltage of Class A Transistor Amplifier<br>P2. Find out V-I characteristics curve. |

**Knowledge and understanding**

- Study the operation of CS Amplifier.
- Study its characteristics curve and parameters.
- Study the operation of CG Amplifier.
- Study its characteristics curve and parameters.
- Study the operation of CD Amplifier.

- Study its characteristics curve and parameters
- Study the operation of Transistor Amplifier.
- Study its characteristics curve and parameters.
- Study the gain of a single Stage Class A Transistor Amplifier.
- Study its characteristics curve and parameters
- Study the operation of common source FET amplifier.
- Study the characteristics curve of common source FET amplifier.
- Study the types of FET amplifier.
- Study the operation of class A Transistor Amplifier.
- Study its characteristics curve and parameters.
- Study the Frequency Response of class A Amplifier.
- Study its characteristics curve and parameters

**Tools & Equipment**

| SN | |
|---|---|
| **1.** | CD Amplifier. |
| **2.** | Class A Transistor Amplifier. |
| **3.** | CS Amplifier. |
| **4.** | Frequency Meter. |
| **5.** | Multimeter |
| **6.** | Oscilloscope/Function Generator |

**Critical Evidence(s) Required**

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

Evidence of the following is essential:

- Working principal FET Amplifier
- Draw Characteristics curve of FET amplifier

## 0714E&A75- Characterize BJT Amplifiers.

**Overview**

This competency standard identifies the competencies required to Characterize BJTs Amplifiers.

| Competency Units | Performance Criteria |
|---|---|
| **CU1. Determine the parameters of transistor.** | P1. Identify Transistor<br>P2. Identify types.<br>P3. Perform biasing of Transistor<br>P4. Identify current and Voltage Ratings. |
| **CU2. Implement Transistor as an amplifier by using CE, CB and CC Configuration.** | P1. Arrange Circuit in CE.<br>P2. Apply Biasing voltage.<br>P3. Observe the difference between input and output voltage level.<br>P4. Observe phase reversal<br>P5. Arrange Circuit in CB.<br>P6. Apply Biasing voltage.<br>P7. Observe the difference between input and output voltage level.<br>P8. Observe phase reversal.<br>P9. Arrange Circuit in CC.<br>P10. Apply Biasing voltage.<br>P11. Observe the difference between input and output voltage level.<br>P12. Observe phase reversal. |
| **CU3. Assemble a Class A Power Amplifier.** | P1. Draw the circuit of a Class A power Amplifier. Measure its parameters.<br>P2. Draw its characteristics curve.<br>P3. Troubleshoot the Class a power Amplifier. |
| **CU4. Measure power gain of a Class A Power Amplifier.** | P1. Calculate the input and output voltage of Class A Power Amplifier<br>P2. Find out gain by dividing output power/input power. |
| **CU5. Assemble an Amplifier and measure its voltages gain.** | P1. Identify the circuit of RF amplifier.<br>P2. Apply the use of RF Amplifier.<br>P3. Find out the voltage gain.<br>P4. Troubleshoot an RF Amplifier.<br>P5. Draw its characteristics curve. |
| **CU6. Assemble the class C operation of RF Amplifier and Measure its power output.** | P1. Draw the circuit of class C RF Amplifiers & measure its parameters.<br>P2. Draw its characteristics curve.<br>P3. Find out output power. |
| **CU7. Apply the frequency response of RC Coupled RF Amplifier** | P1. Draw the circuit of RC Coupled RF Amplifier. Measure its parameters.<br>P2. Draw its characteristics curve.<br>P3. Find out its frequency response curve.<br>P4. Troubleshoot RC coupled RF Amplifier circuit. |

| | |
|---|---|
| | P5. Apply the use of RC coupled RF Amplifier circuit |
| **CU8. Implement frequency response of impedance Coupled RF Amplifier** | P1. Draw the circuit of impedance coupled RF Amplifier. Measure its parameters.<br>P2. Draw its characteristics curve.<br>P3. Find out its impedance response curve.<br>P4. Troubleshoot impedance coupled RF Amplifier circuit.<br>P5. Apply the use of impedance coupled RF Amplifier circuit |
| **CU9. Implement frequency response of Transformer Coupled RF Amplifier** | P1. Draw the circuit of Transformer coupled RF Amplifier. Measure its parameters.<br>P2. Draw its characteristics curve.<br>P3. Troubleshoot Transformer coupled RF Amplifier circuit.<br>P4. Apply the use of Transformer coupled RF Amplifier circuit |
| **CU10. Apply response of RF Amplifier using Tuned load.** | P1. Implement the circuit for Tuned load RF Amplifier. Measure its parameters.<br>P2. Draw its characteristics curve.<br>P3. Troubleshoot Tuned load RF Amplifier circuit<br>P4. Apply the use of Tuned load RF Amplifier circuit |
| **CU11. Identify the frequency response of direct coupled Audio Amplifier** | P1. Arrange circuit diagram<br>P2. Apply voltage to input.<br>P3. Observe output and draw the characteristic curve<br>P4. Determine current and Voltage Ratings. |
| **CU12. Identify the frequency response of RC coupled Audio Amplifier** | P1. Arrange circuit diagram<br>P2. Apply voltage to input.<br>P3. Observe output and draw the characteristic curve<br>P4. Determine current and Voltage Ratings<br>P5. Observe the frequency response. |
| **CU13. Identify the frequency response of transformer coupled and power Amplifier** | P1. Arrange circuit diagram<br>P2. Apply voltage to input.<br>P3. Observe output and draw the characteristic curve<br>P4. Determine current and Voltage Ratings<br>P5. Observe the frequency response and Gain, and distortion ratio. |

**Knowledge and understanding**

- Basic Electronics
- Semiconductor Theory
- Doping Procedure.
- Transistors terminals
- Transistor Biasing.
- Coupling Capacitor.
- V-I Characteristics
- Study the operation of class A Power Amplifier.
- Study its characteristics curve and parameters.
- Study the power gain of a Class A power Amplifier.
- Study its characteristics curve and parameters
- Study the operation of RF Amplifier.
- Study its characteristics curve and parameters
- Study the operation of Class C RF Amplifier.
- Study its characteristics curve and parameters.
- Study the operation of RC Coupled RF Amplifier.
- Study its characteristics curve and parameters.
- Observe its frequency response.
- Study the operation of impedance Coupled RF Amplifier.
- Study its characteristics curve and parameters.
- Observe it impedance response.
- Study the operation of Transformer Coupled RF Amplifier.
- Study its characteristics curve and parameters.
- Study the operation of Tuned load RF Amplifier.
- Study its characteristics curve and parameters.
- Electronics devices
- Study the Theory of directed coupled Audio Amplifier
- Transistors working and modes of operation.

**Tools & Equipment**

| SN | |
|---|---|
| **1.** | Capacitors |
| **2.** | Class A Power Amplifier. |
| **3.** | Class A Transistor Amplifier. |
| **4.** | Class C RF Amplifier. |

| | |
|---|---|
| **5.** | Multimeter |
| **6.** | Oscilloscope/Function Generator |
| **7.** | Power Supplies |
| **8.** | Resistors |
| **9.** | RF Amplifier. |
| **10.** | Trainer |
| **11.** | Transistors |

**Critical Evidence(s) Required**

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

Evidence of the following is essential:

- Design RF amplifier
- Calculate gain of Class A amplifier

## 0714E&A76- Characterize various Oscillators.

**Overview:**
This competency standard identifies the competencies required to characterize oscillators.

| Competency Units | Performance Criteria |
|---|---|
| **CU1. Assemble a RC phase shift oscillator** | P1. Implement the circuit of RC phase shift oscillator and Measure its parameters.<br>P2. Draw its characteristics curve.<br>P3. Apply the use of RC phase shift oscillator circuit.<br>P4. Troubleshoot RC phase shift oscillator. |
| **CU2. Working of a RC phase shift oscillator** | P1. Implement working ofa RC phase shift oscillator.<br>P2. Draw the circuit of a RC phase shift oscillator. Measure its parameters.<br>P3. Troubleshoot of a RC phase shift oscillator<br>P4. Repair of a RC phase shift oscillator. |
| **CU3. Assemble a Hartley oscillator.** | P1. Implement the circuit of Hartley oscillator and Measure its parameters.<br>P2. Draw its characteristics curve.<br>P3. Apply the use of Hartley oscillator circuit.<br>P4. Troubleshoot RC phase shift oscillator. |
| **CU4. Working of a Hartley oscillator.** | P1. Implement working of a Hartley oscillator.<br>P2. Draw the circuit of a Hartley oscillator. Measure its parameters.<br>P3. Troubleshoot of a Hartley oscillator.<br>P4. Repair of a Hartley oscillator. |
| **CU5. Assemble a Colpite oscillator.** | P1. Implement the circuit of Colpite oscillator and Measure its parameters.<br>P2. Draw its characteristics curve.<br>P3. Apply the use of Colpite oscillator circuit.<br>P4. Troubleshoot Colpite oscillator. |
| **CU6. Working of a Colpite oscillator.** | P1. Implement working of a Colpite oscillator.<br>P2. Draw the circuit of a Colpite oscillator. Measure its parameters.<br>P3. Troubleshoot of a Colpite oscillator<br>P4. Repair of a Colpite oscillator |
| **CU7. Assemble a crystal oscillator.** | P1. Implement the circuit of crystal oscillator and Measure its parameters.<br>P2. Draw its characteristics curve.<br>P3. Apply the use of crystal oscillator circuit.<br>P4. Troubleshoot crystal oscillator. |
| **CU8. Implement the working of a crystal oscillator.** | P1. Implement working of crystal oscillator.<br>P2. Draw the circuit of a crystal oscillator. Measure its parameters.<br>P3. Troubleshoot of a crystal oscillator. |

| | |
|---|---|
| | P4. Repair of a crystal oscillator |
| **CU9. Assemble a Pulse Tone oscillator** | P1. Implement the circuit of Pulse Tone oscillator and Measure its parameters.<br>P2. Draw its characteristics curve.<br>P3. Apply the use of Pulse Tone oscillator circuit.<br>P4. Troubleshoot Pulse Tone oscillator . |
| **CU10. Working of a 555 IC as Timer and pulse generator** | P1. Implement working ofa 555 IC.<br>P2. Draw the circuit of a 555 IC and Measure its parameters.<br>P3. Troubleshoot of a 555 IC .<br>P4. Repair of a 555 IC . |
| **CU11. Implement a Pulse Tone oscillator by using 555 IC** | P1. Draw circuit<br>P2. Apply its use<br>P3. Troubleshoot a Pulse Tone oscillator by using 555 IC<br>P4. Repair a Pulse Tone oscillator by using 555 IC |

**Knowledge and understanding**

- Study the operation of RC phase shift oscillator
- Study its characteristics curve and parameters.
- Study the operation Hartley oscillator
- Study its characteristics curve and parameters.
- Study the operation of Colpite oscillator.
- Study its characteristics curve and parameters.
- Study the operation crystal oscillator
- Study its characteristics curve and parameters.
- Study the operation of Pulse Tone oscillator
- Study its characteristics curve and parameters.
- Study the operation 555 IC
- Study its characteristics curve and parameters.

**Tools & Equipment**

| SN | |
|---|---|
| **1.** | 555 IC . |
| **2.** | Colpite Oscillator |
| **3.** | Hartley oscillator. |
| **4.** | Multi-meter. |
| **5.** | Oscilloscope/Function Generator |
| **6.** | RC Phase shift oscillator. |

| **Critical Evidence(s) Required** |
|---|

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

Evidence of the following is essential:

- Construct RC phase oscillator
- Working principal of a 555 IC as Timer and pulse generator

## 0714E&A77- Design an Operation Amplifier.

**Overview:**
This competency standard identifies the competencies required to Construct Operation Amplifier.

| Competency Units | Performance Criteria |
|---|---|
| **CU1. Consult datasheet for OP AMP.** | P1. Download datasheet for various OP AMP's.<br>P2. Identify various data sheets of OP AMP's. |
| **CU2. Working of OP AMP 741,o7** | P1. Draw the circuit of OP AMP.<br>P2. Identify its various components.<br>P3. Apply the use of OP AMP working.<br>P4. Troubleshoot OP AMP circuit.<br>P5. Repair of OP AMP.<br>P6. Characteristics of OP AMP. |
| **CU3. Implement the frequency response of OP AMP.** | P1. Draw the characteristics curve of OP AMP circuit.<br>P2. Find out its frequency response. |
| **CU4. Construct Non Inverting Amplifier with the help of OP AMP.** | P1. Identify Non Inverting Amplifier.<br>P2. Apply OP AMP to construct Non Inverting Amplifier.<br>P3. Troubleshooting of Non inverting Amplifier.<br>P4. Draw its characteristics curve. |
| **CU5. Construct Inverting Amplifier with the help of OP AMP.** | P1. Identify Inverting Amplifier.<br>P2. Apply OP AMP to construct Inverting Amplifier.<br>P3. Troubleshooting of inverting Amplifier.<br>P4. Draw its characteristics curve. |
| **CU6. Construct OP AMP Summer.** | P1. Identify and assemble OP AMP Summer.<br>P2. Implement OPAMP Summer Circuit<br>P3. Perform its operation |
| **CU7. Construct OP AMP Unity Follower.** | P1. Identify and assemble OP AMP Unity Follower.<br>P2. Implement OP AMP Unity Follower's circuit.<br>P3. Perform its operation |
| **CU8. Construct OP AMP Multiplier.** | P1. Identify and assemble OP AMP Multiplier...<br>P2. Implement OP AMP Multiplier's circuit.<br>P3. Perform its operation<br>P4. Trouble shooting<br>P5. Repairing OP AMP Multiplier's circuit. |
| **CU9. Construct OP AMP Integrator.** | P1. Identify and assemble OP AMP Integrator.<br>P2. Implement OP AMP Integrator.<br>P3. Trouble shooting<br>P4. Repairing OP AMP Integrator. |

| | |
|---|---|
| **CU10. Construct OP AMP Differentiator.** | P1. Identify and assemble OP AMP Differentiator.<br>P2. Implement OP AMP Differentiator.<br>P3. Trouble shooting<br>P4. Repairing OP AMP Differentiator.<br>P5. Implement OP AMP Differentiator.<br>P6. Trouble shooting<br>P7. Repairing OP AMP Integrator |
| **CU11. Construct OP AMP Comparator.** | P1. Identify and assemble OP AMP Comparator.<br>P2. Implement OP AMP Comparator.<br>P3. Trouble shooting<br>P4. Repairing OP AMP Comparator. |

**Knowledge and understanding**

- Study the different data sheets for OP AMP's.
- Study its characteristics.
- Study the operation of OP AMP.
- Study the frequency response of OP AMP.
- Understand its characteristics curve.
- Understand working of Non inverting amplifier and OP AMP.
- Understand OP AMP Summer operation
- Study its characteristics.

**Tools & Equipment**

| **SN** | |
|---|---|
| **1.** | Datasheets |
| **2.** | Multi-meter |
| **3.** | OP AMP. |
| **4.** | Oscilloscope/Function Generator |
| **5.** | Pulse tone OP AMP. |

**Critical Evidence(s) Required**

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

Evidence of the following is essential:

- Construct Opamp
- Use opamp as integrator

***Analytical Instruments***

**0714E&A78- Measure Temperature and Humidity:**

**Overview:**
After completion of this competency standard the student will be able to measure humidity, moisture & Temperature using different instruments.

| Competency Units | Performance Criteria |
|---|---|
| **1. Convert various Temperature scales** | P1. Differentiate between heat and temperature<br>P2. Identity measuring units for Heat and Temperature<br>P3. Perform conversion between scales i.e. Kelvin, Celsius and Fahrenheit scales<br>P4. Identify three reference point of temperatures<br>P5. Verify the theoretical and practical outputs |
| **2. Operate various types of Thermometers** | P1. Identify and differentiate various types of temperature sensors.<br>P2. Operate and read the output of the various sensors.<br>P3. Compare performance and accuracy of Mercury bulb thermometer with sensor's base thermometers |
| **3. Measure humidity using different humidity meters** | P1. Setup wet and dry bulb psychomotor.<br>P2. Identify the type of sensor for temperature sensing<br>P3. Perform relative and absolute measurement using wet and dry bulb thermometer.<br>P4. Identify Hydrometer (transducer type) components, Sensor type, Output & Input<br>P5. Measure Humidity inside close container<br>P6. Compare the measured humidity results |

**Knowledge and understanding**

- Learn about Heat
- Learn about Temperature
- Learn to convert and understand meaning of various temperature scales
- Explain thermocouple and temperature sensor.
- Learn the operation of various thermometers
- Explain various types of Humidity metering instruments
- Operation and data analysis of measurements

**Tools & Equipment**

| SN | |
|---|---|
| **1.** | Heater |

| | |
|---|---|
| **2.** | Temperature controller |
| **3.** | Multi-meter |
| **4.** | Power supply |
| **5.** | Temperature sensors |
| **6.** | Mercury bulb thermometer |
| **7.** | Humidity sensors and transducer |

## Critical Evidence(s) Required

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

Evidence of the following is essential:

- Convert Fahrenheit scale to Kelvin scale
- Compare the measured humidity results

## 0714E&A79- Measure the Density & Power of Hydrogen ion (pH)

**Overview**

After completion of this competency standard the student will be able to measure the Density & pH of substances using a variety of measuring instruments.

| Competency Units | Performance Criteria |
|---|---|
| **1. Analyze Density by various techniques** | P1. Differentiate digital and glass hydrometer<br>P2. Perform measurements for different liquids<br>P3. Setup filling ball apparatus and identify their building blocks.<br>P4. Measuring density of oil by filling ball apparatus.<br>P5. Setup fixed volume weight apparatus for density measurement<br>P6. Perform measurement of density for various liquid by “fixed volume weight apparatus”.<br>P7. Compare the measured results<br>P8. Perform analysis and find the causes of variation in results (if any).<br>P9. Generate a report |
| **2. Measure specific gravity in relation with density** | P1. Setup displacer method apparatus.<br>P2. Perform measurements for various liquids<br>P3. Perform measurement of density by “fixed volume weight apparatus”.<br>P4. Compare the measured results<br>P5. Find the causes of variation in results (if any).<br>P6. Generate an output report |
| **1. Measure the pH by different techniques** | P1. Identify the litmus paper technique to measure the pH of solution.<br>P2. Identify the default color of litmus paper<br>P3. Identify the color variation of litmus paper in the Reference literature<br>P4. Prepare solutions of acidic / basic concentrations.<br>P5. Dip litmus paper in the solution in periodic way and observe the change in color<br>P6. Record the values<br>P7. Identify digital pH meter based on Electrode.<br>P8. Apply the calibration procedure of the instrument<br>P9. Measure the pH of all prepared solutions by digital pH meter<br>P10. Compare the results measured by litmus paper and digital pH meter.<br>P11. Analyze the variation in data, experimental time / complications and prepare write up. |

**Knowledge and understanding**

- Learn about density measurement techniques and their measuring instruments

- Learn acidic and basic behavior of solutions
- Learn the operation, calibration and measurements by using the digital pH meter based on Electrode.
- Learn the techniques about measuring pH in solutions.
- Understand the litmus paper technique for measuring pH.
- Understand the operation, measurement, analysis of the specific gravity measuring instruments.
- Understand the specific gravity in relation with density.
- Variation in results in the due to application of several techniques.

**Tools & Equipment**

| SN | |
|---|---|
| **1.** | Heater |
| **2.** | Temperature controller and meter |
| **3.** | Multi-meter |
| **4.** | sensors |
| **5.** | Power supply |
| **6.** | Reference sample / materials |
| **7.** | Reference solutions |

**Critical Evidence(s) Required**

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

Evidence of the following is essential:

- Measure pH level
- Prepare solutions of acidic / basic concentrations

## 0714E&A80- Measure the concentration of Environmental Gases

**Overview:**

After completion of this competency standard the student will be able to measure the concentration of various environmental Gases such as Oxygen, Carbon dioxides, Nitrogen, Carbon monoxides which play key role in defining the working environmental conditions in the industries and offices.

| Competency Units | Performance Criteria |
|---|---|
| **1. Measure the concentration of important gases** | P1. Identify Oxygen and its parameter for the environmental conditions inside close environments.<br>P2. Identify Carbon monoxides and its parameter for the environmental conditions inside close environments.<br>P3. Identify carbon dioxides and its parameter for the environmental conditions inside close environments.<br>P4. Identify Nitrogen and its parameters for the environmental conditions inside close environments.<br>P5. Identify thermal conductivity analyzer instrument and it important building blocks,<br>P6. Setup and arrange the known concentration storage of oxygen, carbon dioxide, carbon monoxide and Nitrogen.<br>P7. Perform measurements by using thermal conductivity analyzer for the known concentration of all gaseous and check the deviation in the measured and reference values.<br>P8. Setup and arrange unknown concentration of the gaseous and measured their concentration by using Thermal analyzer instrument and record the data.<br>P9. Identify Carbon monoxide analyzer instrument with it basic building blocks<br>P10. Setup and arrange unknown concentration of carbon monoxide and measured their concentration by using “carbon monoxide analyzer instrument and record data.<br>P11. Identify Para-magnetic oxygen detector instrument with it basic building blocks<br>P12. Arrange unknown concentration of Oxygen and measured their concentration by using “paramagnetic oxygen detector and record data.<br>P13. Compare, analyze and interpret the data and comments on the deviation and discrepancies in relation with the reference data and instrumental techniques.<br>P14. Create an output report |

| | |
|---|---|
| **2. Analyze flue Gas analyzer instrument** | P1. Identify the basic building block for the flue gas analyzer components.<br>P2. Identify sensor types uses for the different gases, i.e. for CO, O, Nitrogen etc<br>P3. Calibrate (see user manual) the instrument with known gaseous concentrations.<br>P4. Perform measurement for the all gaseous and record the results.<br>P5. Compare the measured values with the above data and reference values.<br>P6. Analyze and interpret the discrepancies, errors and deviations.<br>P7. Generate an output report. |

**Knowledge and understanding**

- Learn environmental gases present and their required concentrations and parameters
- Understand the limits and dangers about the gaseous concentration.
- Learn the operation, calibration and measurements by using the thermal conductivity analyzer.
- Learn the basic, operation, calibration and measurements by using the Flue gas analyzer Instrument.

**Tools & Equipment**

| **SN** | |
|---|---|
| **1.** | Multimeter |
| **2.** | Thermal Conductivity analyzer setup/instrument. |
| **3.** | Known concentration of storage Oxygen, Nitrogen, Carbon dioxide, Carbon Monoxides |
| **4.** | Sample storage container for measuring the unknown concentration |

## 0714E&A81- Analyse the Gas Chromatography

**Overview:** After the completion of this competency standard the student will be able to apply the Chromatographs in wide range of industries for detection of various concentrations in liquid and gases during the production or analytical routine procedures.

| Competency Units | Performance Criteria |
|---|---|
| **1. Operate Gas chromatograph by (GC) instrument** | P1. Identify Burner assembly<br>P2. Identify column and it characteristic parameters.<br>P3. Understand the mechanism and working principle of Burner assembly.<br>P4. Identify and understand the working mechanism of carrier gas assembly.<br>P5. Identify the type of used Detector assembly and read it application parameters and detection mechanism, i.e. Photo multiplier tube (PMT) etc<br>P6. Identify Signal processing /conditioning circuits<br>P7. Identify Data processing and control software parameters and settings.<br>P8. Perform measurements by Gas spectrograph for various gaseous and record the data.<br>P9. Perform measurements by Column type Gas spectrograph for various gaseous and record the data.<br>P10. Differentiate between the data measured by “Gas Chromatograph” and “column type chromatograph” and write a report.<br>P11. Compare, analyze and interpret the all measured data and comments on the deviation and discrepancies in relation with the reference database stored in the machine.<br>P12. Construct an output report. |
| **2. Characterize Liquid chromatography instrument** | P1. Identify Burner assembly<br>P2. Identify column and it characteristic parameters.<br>P3. Understand the mechanism and working principle of Burner assembly.<br>P4. Identify and understand the working mechanism of carrier gas assembly.<br>P5. Identify the type of used Detector assembly and read it application parameters and detection mechanism, i.e. Photo multiplier tube (PMT) etc<br>P6. Identify Signal processing /conditioning circuits<br>P7. Identify Data processing and control software parameters and settings.<br>P8. Identify Data comparison, analysis and interpretation.<br>P9. Perform measurements by chromatograph spectrograph for various gaseous and record the data. |

| | |
|---|---|
| | P10. Compare, analyzed and interpret the data and comments on the deviation and discrepancies in relation with the reference database stored in the machine.<br>P11. Create an output report. |

**Knowledge and understanding**

**Learn basic Gas chromatography techniques and it applications.**
**Understand the working mechanism, operation and data analysis procedures of the Gas Chromatograph.**

**Tools & Equipment**

| SN | |
|---|---|
| **1** | Multimeter |
| **2** | Known concentration of the reference and sample gaseous. |
| **3** | Gas chromatograph instrument |
| **4** | Data acquisition and analysis software |
| **5** | Reference experimental data stored in the database for comparison. |

**Critical Evidence(s) Required**

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

Evidence of the following is essential:

- Operate Gas chromatograph by (GC) instrument
- Identify and understand the working mechanism of carrier gas assembly

## 0714E&A82- Perform the Spectroscopic characterization

**Overview:** After the completion of this competency standard the student will be able to characterize various techniques of spectroscopy that are widely used for analytical purpose in Pharmaceutical, chemical, food and Pathological labs.

| Competency Units | Performance Criteria |
|---|---|
| **1. Operate the Dispersive type Spectrometer in (Visible)** | P1. Identify Optical box containing Prism or grating, lenses and mirrors, detector type, signal conditioning unit, sample compartment and data processing unit.<br>P2. Setup the spectrometer in visible range and observe the visible beam path.<br>P3. Identify the sample and or reference compartment<br>P4. Locate the dispersed spectra after grating or prism and change it position by moving the mirrors positions or prism or grating rotation degree.<br>P5. Move back or forth and or up-down in order to change the position of colors on the slit entering the sample or reference compartment.<br>P6. Observe the beam entering in the sample compartment after passing through the slits and observe the change in colors with rotation changing. Identify column and it characteristic parameters.<br>P7. Observe the beam exiting from the sample compartment and reaching to the Detector and check the output of the Detector or circuit and record the milli-volt.<br>P8. Prepare or arrange the sample and reference material for the spectrometer.<br>P9. Measure the reference and data or spectra separately and calculate the results.<br>P10. Compare, analyzed and interpret the all measured data and comments on the deviation and discrepancies in relation with the reference database.<br>P11. Conclude and write a report. |
| **2. Operate the Interferometer type spectrometer** | P1. Identify Optical box containing Interferometer, lenses and mirrors, detector type, signal conditioning unit, sample compartment and data processing unit.<br>P2. Setup the spectrometer in visible range and observe the visible beam path.<br>P3. Locate the output spectra from Interferometer and change it movable mirror position and observe the change in output.<br>P4. Observe the beam entering in the sample compartment after passing through the slits and observe the change in colors with rotation changing.<br>P5. Observe the beam exiting from the sample |

| | |
|---|---|
| | compartment and reaching to the Detector and check the output of the Detector or circuit and record the millivolt.<br>P6. Prepare or arrange the sample and reference material for the spectrometer.<br>P7. Measure the reference and data or spectra separately and calculate the processed spectra.<br>P8. Compare the experimental time, accuracy and resolution of the data with the Dispersive type spectrometer.<br>P9. Compare, analyzed and interpret the all measured data and comments on the deviation and discrepancies in relation with the reference database.<br>P10. Create output report. |
| **3. Operate the FTIR (Four Transform Infrared) Spectrometer** | P1. Identify Optical box containing Interferometer, lenses and mirrors, detector type, signal conditioning unit, sample compartment and data processing unit.<br>P2. Locate or arrange infrared detector device and observe it working principle.<br>P3. Setup the spectrometer in visible range and observe the visible beam path.<br>P4. Locate the output spectra from Interferometer by using Infrared detecting device and change it movable mirror position and observe the change in output.<br>P5. Observe the beam entering in the sample compartment after passing through the slits and observe the change in colors with rotation changing.<br>P6. Observe the beam exiting from the sample compartment and reaching to the Detector and check the output of the Detector or circuit and record the millivolt.<br>P7. Identify and observer Fourier transformation of the signal or spectra.<br>P8. Prepare or arrange the sample and reference material for the spectrometer.<br>P9. Measure the reference and data or spectra separately and calculate the processed spectra.<br>P10. Compare, analyzed and interpret the all measured data and comments on the deviation and discrepancies in relation with the reference database.<br>P11. Compare the experimental time, accuracy and resolution with the dispersive type infrared spectrometer (if available)<br>P12. Conclude and write a report. |
| **4. Operate the Refracto-Meter** | P1. Identify Sensor and its type parameters, Input - output blocks, sample compartment, signal processing or conditioning units, processing units. |

| | |
|---|---|
| | P2. Locate and observe the beam path (if possible) in relation with the sample compartment and detector circuit.<br>P3. Prepare or arrange sample (liquid) and reference materials and literature database.<br>P4. Measure the data or spectra for the various samples and references and calculate the resultant data or spectra.<br>P5. Compare, analyzed and interpret the all measured data and comments on the deviation and discrepancies in relation with the reference database.<br>P6. Conclude and write a report |
| **Analyze the spectra using luminance meter** | P1. Identify Sensor and its type parameters, Input - output blocks, signal processing or conditioning units, data processing units.<br>P2. Prepare or arrange sample (bio material) and reference material and their literature's database.<br>P3. Measure the data or spectra for the various bio-materials and record the data or spectra.<br>P4. Compare, analyzed and interpret the all measured data and comments on the deviation and discrepancies in relation with the reference database.<br>P5. P5. Create an output |

**Knowledge and understanding**

- Learn basic Gas chromatography techniques and it applications.
- Understand the working mechanism, operation and data analysis procedures of the Gas Chromatography.
- Learn basic of the visible dispersive spectrometer a it basic building and functional blocks and it working principles, techniques and its applications.
- Learn about Fourier Transformation and its advantageous over conventional data processing techniques.
- Understand the working mechanism, operation and data analysis procedures of used in spectroscopy.
- Learn basic of the visible infrared light and it detection mechanism.

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**Tools & Equipment**

| **SN** | |
|---|---|
| **1.** | Multimeter |
| **2.** | Known concentration of the reference and sample materials. |
| **3.** | Dispersive (grating or prism) type spectrophotometer |
| **4.** | Data acquisition and analysis software |
| **5.** | Reference experimental data stored in the database for comparison. |

## Critical Evidence(s) Required

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

Evidence of the following is essential:

- Operate the Dispersive type Spectrometer in (Visible)
- Use of Spectrometer

***Industrial Instrumentation & Control (IT-304)***

**0714E&A83- Design & Implement a Process Control**

**Overview**

After completing this competency standard the student will be able to understand the functions, uses and design process control.

| Competency Units | Performance Criteria |
|---|---|
| **CU1. Design an Open loop Process Control circuit** | P1. Select the type of process control<br>P2. Classify the work output to be taken<br>P3. Sketch a paper circuit for the required process control<br>P4. Construct the Open loop process control circuit<br>P5. Generate an output report |
| **CU2. Design a Closed Loop Process control circuit** | P1. Select the type of process control<br>P2. Classify the work output to be taken<br>P3. Sketch a paper circuit for the required process control<br>P4. Construct the Closed loop process control circuit<br>P5. Construct a Feedback circuit<br>P5. Generate an output report |

| | |
|---|---|
| **CU3. Implement the ON/OFF Control Mode** | P1. Analyze the type of control mode to be installed<br>P2. Select the appropriate type of control mode<br>P3. Install the desired control mode type as per the installation instructions<br>P4. Perform a test run on the ON/OFF control mode<br>P5. Generate the Output report |
| **CU4. Implement the PID Control Mode** | P1. Analyze the type of control mode to be installed<br>P2. Select the appropriate type of control mode<br>P3. Install the desired control mode type as per the installation instructions<br>P4. Perform a test run on the P control mode<br>P5. Perform a test run on the PI control mode<br>P6. Perform a test run on the PID control mode<br>P7. Generate the Output report |

**Knowledge and understanding**

- Define process control, its working principles and uses in industry.
- Define process control, its working principles and uses in industry.
- Describe the advantages and disadvantages of ON/OFF control mode
- Describe the importance and method of PID control mode
- Describe the Industrial control phenomenon.
- Describe the method of ON/OFF control mode
- Explain the basic drawing skills
- Explain the PID control or manual mode
- Explain the process measuring instruments.

**Tools & Equipment**

| SN | |
|---|---|
| **1.** | 4-20 m amps devices |
| **2.** | Indicators |
| **3.** | IP Valves |

| | |
|---|---|
| **4.** | Multi-meter |
| **5.** | PID controller |
| **6.** | Plotting Paper |
| **7.** | Pneumatic valves and supply |
| **8.** | SCR |
| **9.** | Sketch Board |
| **10.** | Soldering iron, Rods |
| **11.** | SSR |
| **12.** | Tool kit |
| **13.** | Transistors, MOSFET |

**Critical Evidence(s) Required**

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

Evidence of the following is essential:

- Differentiate various application of closed loop and open loop control system
- Identify different pin configuration of PID controller using data sheet

## 0714E&A84- Install the Transducers & Industrial Transmitters

**Overview:**
After completion of this competency standard the student will be able to grasp the uses, basic concepts and installation of transducers and industrial Transmitters.

| Competency Units | Performance Criteria |
|---|---|
| **Apply the P/I and I/P Transducers.** | P1. Analyze the type of transducer to be installed<br>P2. Install the desired type of transducer as per the installations manual<br>P3. Perform the post installation measures<br>P4. Generate an output report for the transducer |
| **Install the Differential Pressure Transmitters.** | P1. Analyze the type of DP Transmitter to be installed<br>P2. Locate the point of installation for DP transmitter<br>P3. Install the DP Transmitter as per the installations manual.<br>P4. Perform Post Installation measures.<br>P5. Generate an output report for the transmitter |
| **3. Install the Pneumatic Transmitter in Industry** | P1. Analyze the type of Pneumatic Transmitter to be installed<br>P2. Locate the point of installation for Pneumatic transmitter<br>P3. Install the Pneumatic Transmitter as per the installations manual.<br>P4. Perform Post Installation measures.<br>P5. Generate an output report for the transmitter |

**Knowledge and understanding**

- Describe the working principle of DP transmitter.
- Describe the working principle of Pneumatic transmitter.
- Describe the working principles of P/I & I/P Transducers.
- Explain the applications of P/I & I/P transducers in industry
- Explain the criteria of installation and calibration of P/I ,I/P transducers
- Explain the DP transmitter and its types.
- Explain the Installation & calibration procedures of DP transmitter
- Explain the Installation & calibration procedures of Pneumatic transmitter
- Explain the Pneumatic transmitter and its types.

**Tools & Equipment**

| SN |
|---|

| | |
|---|---|
| **1.** | Calibrator |
| **2.** | Calibrator probes |
| **3.** | Compressor |
| **4.** | DP Transmitter |
| **5.** | I/P AND P/I Transducers |
| **6.** | Multi-meter |
| **7.** | Pneumatic Transmitter |

**Critical Evidence(s) Required**

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

Evidence of the following is essential:

- Differentiate various type of transducers
- Pin diagram and connectivity of pressure transmitter

## 0714E&A85- Install the Process Regulators & Actuators

**Overview:** After completion of this competency standard the student will be able to grasp the uses, basic concepts and installation of regulator and actuators.

| Competency Units | Performance Criteria |
|---|---|
| **1. Install the regulator in application** | P1. Analyze the type of regulator to be installed<br>P2. Select the appropriate type of regulator<br>P3. Install the desired regulator type as per the installation instructions<br>P4. Perform a test run on the regulator installed<br>P5. Generate the Output report |
| **2. Install the Flow Control Actuators in application** | P1. Analyze the type of Actuator to be installed<br>P2. Select the appropriate type of Actuator<br>P3. Install the desired Actuator type as per the installation instructions<br>P4. Perform a test run on the Actuator installed<br>P5. Generate the Output report |
| **3. analyze the Power Controlling Devices** | P1. Analyze the type of Power Controlling Device to be installed<br>P2. Select the appropriate type of Power Controlling Device<br>P3. Install the desired Power Controlling Device type as per the installation instructions<br>P4. Perform a test run on the Power Controlling Device<br>P5. Generate the Output report |
| **4. Install the Motor in Application** | P1. Analyze the type of motor to be installed<br>P2. Select the appropriate type of motor<br>P3. Install the desired motor type as per the installation manual<br>P4. Perform a test run on the motor<br>P5. Generate the Output report |

**Knowledge and understanding**

- Describe the installation and calibration criteria of Actuator
- Describe the installation and calibration criteria of motor
- Describe the installation and calibration criteria of Power Controlling Device
- Explain the Actuator , Its Types and working principles
- Explain the Motor, Its Types and working principles
- Explain the Power Controlling Device , Its Types and working principles

**Tools & Equipment**

| SN | |
|---|---|
| **1.** | Butterfly Valve |
| **2.** | Caliberator |
| **3.** | Differential Valve |
| **4.** | Flow meter |
| **5.** | Globe Valve |
| **6.** | IGBT Module |
| **7.** | Mosc controlled thyristor Module |
| **8.** | Multimeter |
| **9.** | Pressure controlled Regulator |
| **10.** | Product manual |
| **11.** | Rotary Plug Valve |
| **12.** | SCR Module |
| **13.** | Spring-regulator |
| **14.** | Switching Relays |
| **15.** | TRIAC Module |
| **16.** | Weight Regulator |

## Critical Evidence(s) Required

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

Evidence of the following is essential:

- Identify power control devices
- Pin diagram and connectivity of flow control sensor

## 0714E&A86- Install the Variable Frequency Drive-VFD

**Overview:** After completion of this competency standard the student will be able to grasp the uses, basic concepts and installation of VFD.

| Competency Units | Performance Criteria |
|---|---|
| **1. Install the Variable Frequency Drive** | P1. Analyze the type of VFD to be installed<br>P2. Select the appropriate type of VFD<br>P3. Install the desired VFD type as per the installation instructions<br>P4. Perform a test run on the VFD<br>P5. Generate the Output report |
| **2. Perform the Parameterization process** | P1. Analyze the required parameter<br>P2. Select the appropriate parameter<br>P3. Perform Parameter downloading<br>P4. Perform a test run with parameter<br>P5. Generate the output report |

**Knowledge and understanding**

- Explain the VFD, Its Types and working principles
- Describe the installation and commissioning
- Explain the VFD parameter procedure
- Describe the importance of Parameterization
- Describe the speed control by VFD

**Tools & Equipment**

| SN | |
|---|---|
| **1.** | Servo-VFD |
| **2.** | Induction Motor |
| **3.** | Servo Motor |
| **4.** | Multi-meter |
| **5.** | Tool kit |
| **6.** | Product manual |
| **7.** | Keypad |

**Critical Evidence(s) Required**

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

Evidence of the following is essential:

- Control Speed by VFD
- Working principle of servo VFD induction motor

## 0714E&A87- Install the Pneumatic & Hydraulic Systems in Industry

**Overview:** After completion of this competency standard the student will be able to grasp the uses, basic concepts and installation of pneumatic and hydraulic system.

| Competency Units | Performance Criteria |
|---|---|
| **1. Install Hydraulic Equipment.** | P1. Analyze the type of hydraulic to be installed<br>P2. Select the appropriate type of hydraulic<br>P3. Install the desired hydraulic type as per the installation instructions<br>P4. Perform a test run on the hydraulic equipment<br>P7. Generate the Output report |
| **2. Perform equipment maintenance** | P1. Analyze the type of hydraulic maintenance required<br>P2. Select the appropriate procedure of hydraulic maintenance<br>P3. Inspect the Pressure, Seal, Spring, Piston and oil level<br>P4. Service the equipment as per the servicing manual |
| **3.Install Pneumatic Equipment** | P1. Analyze the type of Pneumatic to be installed<br>P2. Select the appropriate type of Pneumatic<br>P3. Install the desired Pneumatic type equipment as per the installation instructions<br>P4. Perform a test run on the Pneumatic equipment<br>P7. Generate the Output report |

**Knowledge and understanding**

- Describe the advantages of hydraulic system
- Describe the advantages of Pneumatic system
- Describe the importance and requirement of hydraulic
- Describe the importance and requirement of Pneumatic
- Describe the method of checking pressure.
- Describe the method of Cleaning and oil level
- Explain the hydraulic maintenance procedures
- Explain the hydraulic system, types and working principle
- Explain the Pneumatic system, types and working principle

**Tools & Equipment**

| SN | |
|---|---|
| **1.** | Calibrator |
| **2.** | Compressor |
| **3.** | Hydraulic Pumps |
| **4.** | Hydraulic Regulator |
| **5.** | Hydraulic Relays |
| **6.** | Magnetic coil |

| | |
|---|---|
| **7.** | Piston |
| **8.** | Pneumatic Valves |
| **9.** | Pressure tester |
| **10.** | Seal, |
| **11.** | Sensors |
| **12.** | Spring |
| **13.** | Valves |

**Critical Evidence(s) Required**

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

Evidence of the following is essential:

- Working principle of Pneumatic system
- Perform a test run on the hydraulic equipment

***Digital Circuits & Microprocessor Applications***

## 0714E&A88- Classify the Digital Logic Gates

**Overview:**

After this competency standard the student will be able to identify variety of digital logic gates ICs and their usage in industry.

| Competency Units | Performance Criteria |
|---|---|
| **CU1.** Identify Various Logic gates ICs | P1. Identify the Logic gate ICs<br>P2. Identify its types & polarities<br>P3. Draw the different circuits with the help of logic gates ICs |
| **CU2.** Implement OR gate IC | P1. Identify OR gate IC<br>P2. Design different circuits with the help of OR gate IC<br>P3. Operate DC motor,Relay,7segment,Decoder, and Led with the aid of OR gate IC<br>P4. Interface sensors(IR Sensor, Proximity Sensor, LDR Sensor, Limit Switch and more) at the inputs of OR gate IC for understanding Automation<br>P5. Check input/ouptut waveforms of IC on Oscilloscope |
| **CU3.** Design a circuit based on logic gates using Boolean Expressions. | P1.Summarize the prescribed Boolean Expression.<br>P2.Implement on logic gates.<br>P3. Check input/ouptut waveforms of task on Oscilloscope |
| **CU4.** Implement AND gate IC | P1. Identify AND gate IC<br>P2. Design different circuits with the help of AND gate IC<br>P3. Operate DC motor,Relay,7segment,,Decoder,and Led with the aid of AND gate IC<br>P4. Interface sensors at the inputs of AND gate IC for understanding Automation<br>P5. Check input/output waveforms of IC on Oscilloscope |
| **CU5.** Implement NAND gate IC | P1. Identify NAND gate IC<br>P2. Design different circuits with the help of NAND gate IC<br>P3. Operate DC motor,Relay,7segment,,Decoder,and Led with the aid of NAND gate IC<br>P4. Interface sensors(IR Sensor, Proximity Sensor, LDR Sensor, Limit Switch and more) at the inputs of NAND gate IC for understanding Automation<br>P5. Check input/output waveforms of IC on Oscilloscope |

| | |
|---|---|
| **CU6.** Implement NOR gate IC | P1. Identify NOR gate IC<br>P2. Design different circuits with the help of NOR gate IC<br>P3. Operate DC motor,Relay,7segment,,Decoder, and Led with the aid of NOR gate IC<br>P4. Interface sensors(IR Sensor, Proximity Sensor, LDR Sensor, Limit Switch and more) at the inputs of NOR gate IC for understanding Automation<br>P5. Check input/output waveforms of IC on Oscilloscope |
| **CU7.** Implement XOR gate IC | P1. Identify XOR gate IC<br>P2. Design different circuits with the help of XOR gate IC<br>P3. Operate DC motor, Relay and LED with the help of XOR gate IC<br>P4. Interface sensors(IR Sensor, Proximity Sensor, LDR Sensor, Limit Switch and more) at the inputs of XOR gate IC for understanding Automation<br>P5. Check input/output waveforms of IC on Oscilloscope |
| **CU8.** Implement XNOR gate IC | P1. Identify XNOR gate IC<br>P2. Design different circuits with the help of XNOR gate IC<br>P3. Operate DC motor,Relay,7segment,,Decoder, and Led with the aid of XNOR gate IC<br>P4. Interface sensors(IR Sensor, Proximity Sensor, LDR Sensor, Limit Switch and more) at the inputs of XNOR gate IC for understanding Automation<br>P5. Check input/ouptut waveforms of IC on Oscilloscope |
| **CU9.** Design a circuit by using FLIP FLOP(SR/JK/D) IC | P1.Identify FLIP FLOP IC Design different circuits with the help of FLIP FLOP IC<br>P2.Operate DC motor, Relay and Led with the help of FLIP FLOP IC<br>P3.Interface sensors(IR Sensor, Proximity Sensor, LDR Sensor, Limit Switch and more) at the inputs of FLIP FLOP IC for understanding Automation<br>P4.Construct counter, digital clock with aid of FLIP FLOP ICs<br>P5.Serial and Parallel transfer of information from one register to others with the help of FLIP FLOP ICs<br>P6.Binary up and down counter with the aid of FLIP FLOP ICs<br>P7.Design a traffic light controller.<br>P8.Check input/output waveforms of IC on Oscilloscope |
| **CU10.** Design a circuit by using Multiplexer and De-multiplexer | P1.Construct a circuit for operating led by using Multiplexer<br>P2.Construct a circuit for operating LED's by using |

| | |
|---|---|
| | De-Multiplexer<br>P3. Check input/output waveforms of Mux and De-Mux on Oscilloscope |

**Knowledge and understanding**

- Learn to identify AND gate IC & their applications in different circuits
- Learn to identify FLIP FLOP IC & their applications in different circuits
- Learn to identify logic gates ICs, polarities & their applications in circuits
- Learn to identify MUX, DEMUX and their applications in different circuits
- Learn to identify NAND gate IC & their applications in different circuits
- Learn to identify NOR gate IC & their applications in different circuits
- Learn to identify OR gate IC & their applications in different circuits
- Learn to identify XNOR gate IC & their applications in different circuits
- Learn to identify XOR gate IC & their applications in different circuits
- Understand multi-meter & power Supply
- Understand the data sheets

**Tools & Equipment**

| SN | |
|---|---|
| **1.** | Actuators |
| **2.** | AND gate IC |
| **3.** | Digital Oscilloscope |
| **4.** | Multimeter |
| **5.** | OR gate IC |
| **6.** | Power supply |
| **7.** | Relays |
| **8.** | Sensors |
| **9.** | Trainer |

**Critical Evidence(s) Required**

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

Evidence of the following is essential:

- Identify various gates and their data sheet
- Design a circuit by using Multiplexer and De-multiplexer

## 0714E&A89- Design Microprocessor applications

**Overview**

After completion of this competency standard the student will be able to perform a variety of tasks on a microprocessor and will be able to integrate the programming knowledge into the microprocessor

| Competency Units | Performance Criteria |
|---|---|
| **CU1.** Identify microprocessors | P1. Identify processor features and Pin-Configuration<br>P2. Draw the Microprocessor architecture<br>P3. Compare and contrast the characteristics of Microprocessor & Microcontroller<br>P4. Implement micro-processor selection criteria |
| **CU2.** Identify function of microprocessors and their associated pins | P1. Identify processor features and Pin-Configuration<br>P2. Draw the Microprocessor architecture<br>P3. Compare and contrast the characteristics of Microprocessor & Microcontroller<br>P4. Implement micro-processor selection criteria |
| **CU3.** Program a microprocessor using basic instruction set | P1. Implement Basic instruction set and explain any<br>P2. Implement addressing mode<br>P3. Implement data transfer via accumulator |
| **CU4.** Program a microprocessor to perform basic arithmetic and logical operation | P1. Implement arithmetic and logical operation.<br>P2. Addition & Subtraction<br>P3. Multiplication & Division<br>P4. AND, OR, NOT operation<br>P5. Jump operation |
| **CU5.** Program a microprocessor to perform special operations | P1. Implement special function operations<br>P2. Loops<br>P3. Input / Output<br>P4. Subroutines and interrupt<br>P5. Explain Debugging and its procedure |

**Knowledge and understanding**

- Learn to identify microprocessor IC & their applications in different circuits
- Learn to identify Functions of microprocessor & their applications in different circuits
- Learn to Understand Instruction Sets and how to read and implement them
- Learn to Understand Memory types, their allocation and addressing procedures
- Learn to Implement basic microprocessor operations including move, arithmetic and logical operations
- Learn to implement Loops, Conditions, IOs, Subroutines, Interrupt and other Special function registers
- Learn to troubleshoot the problems via debugging tool

**Tools & Equipment**

| SN | |
|---|---|
| **1.** | Microprocessor |
| **2.** | Development Kit |
| **3.** | Breadboard |
| **4.** | IC remover tool |
| **5.** | Voltmeter |
| **6.** | Programming Computer |
| **7.** | Power supply |
| **8.** | Trainer |

## Critical Evidence(s) Required

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

Evidence of the following is essential:

- Identify various microprocessor and there data sheet
- Program a microprocessor to perform complex set of instructions

## 0714E&A90- Design Microcontroller applications

**Overview**

After completion of this competency standard the student will be able to perform a variety of tasks on a microprocessor and will be able to integrate the programming knowledge into the microprocessor

| Competency Units | Performance Criteria |
|---|---|
| **CU1.** Identify microcontrollers | P1. Draw the microcontroller architecture<br>P2. Implement microcontroller selection criteria |
| **CU2.** Perform BCD addition and subtraction using Microcontroller | P1. Draw the schematic diagram of microcontroller for BCD addition and subtraction operation<br>P2. Select the components of microcontroller for BCD addition and subtraction operation<br>P3. Implement the circuit of microcontroller for BCD addition and subtraction operation<br>P4. Program the microcontroller for BCD addition Functions<br>P5. Apply the Inputs and verify the output,<br>P6. Program the microcontroller for subtraction Functions<br>P7. Apply the Inputs and verify the output,.<br>P8. Generate Lab report |
| **CU3.** Perform multiplication and division using Microcontroller | P1. Draw the schematic diagram of microcontroller for multiplication and division operation<br>P2. Select the components of microcontroller for multiplication and division operation<br>P3. Implement the circuit of microcontroller for multiplication and division operation<br>P4. Program the microcontroller for multiplication Functions<br>P5. Apply the Inputs and verify the output,<br>P6. Program the microcontroller division<br>P7. Apply the Inputs and verify the output,.<br>P8. Generate Lab report |
| **CU4.** Perform the operation to convert Centigrade in to Fahrenheit using Microcontroller | P1. Draw the schematic diagram of microcontroller for the conversion of Centigrade to Fahrenheit<br>P2. Select the components of microcontroller for the conversion of Centigrade to Fahrenheit<br>P3. Implement the circuit of microcontroller for the conversion of Centigrade to Fahrenheit<br>P4. Program the microcontroller for the conversion of Centigrade to Fahrenheit |

| | |
|---|---|
| | P5. Apply the Inputs and verify the output<br>P6. Generate Lab report |
| **CU5.** Interface LCD with microcontroller | P1. Identify the pins of LCD and its function<br>P2. Draw the schematic diagram of LCD interfacing with microcontroller<br>P3. Select the components of LCD interfacing with microcontroller<br>P4. Implement the circuit of LCD interfacing with microcontroller<br>P5. Interface the LED with microcontroller via programming<br>P6. Generate the hex file and load in microcontroller<br>P7. Monitor the output<br>P8. Generate Lab report |

**Knowledge and understanding**

- Learn to identify Microcontroller IC & their applications in different circuits
- Learn to perform Arithmetic operation & their applications in different circuits
- Learn to perform Logical operation & their applications in circuits
- Learn to perform Digital IO operation and their applications in different circuits
- Learn to perform Analog IO operation and their applications in different circuits
- Learn to interface LCD & their applications in different circuits

**Tools & Equipment**

| SN | |
|---|---|
| **1.** | Microcontroller |
| **2.** | Development Kit |
| **3.** | Breadboard |
| **4.** | IC remover tool |
| **5.** | Voltmeter |
| **6.** | Programming Computer |
| **7.** | Power supply |
| **8.** | Trainer |

**Critical Evidence(s) Required**

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

Evidence of the following is essential:

- Identify various microcontrollers and their data sheet
- Program a microcontroller to take environment data and show at LCD

***Advance Control System***

**0714E&A91- Construct an advance Automation & Control system**

Overview

| Competency Units | Performance Criteria |
|---|---|
| **1. Program a PLC to implement different programmable function.** | P1. Identify PLC languages<br>Ladder<br>FBD<br>STL<br>P2. Program a PLC to demonstrate various functions. (Timers, Counters, Arithmetic and logical)<br>P3. Program a PLC to run a motor according to industrial application constraints. |
| **2. Implement industrial application using instruments and communication system** | P1. Sketch the process of application (Flowchart, Pseudo code)<br>P2. Identify process data and communication protocols and their specification<br>P3. Implement open/close loop motor control<br>P3. Implement a communication BUS system to monitor remote data |

**Knowledge and understanding**

- Explain PLC logic functions (gates, timers, counters, user function)
- Describe programming components of PLC.
- Explain the foundations of programming software and debugging tools.
- Explain the data in PLC, HMI and SCADA
- Develop flowcharts and Pseudo code
- Analyze and differentiate process measurements
- Explain communication type and topologies.
- Describe protocols, debugging software and tools.
- Explain the working of open/closed loop controls
- Develop Graphical User Interface (GUI / HMI)

**Tools & Equipment**

| SN | |
|---|---|
| **1.** | Latest programming software and tools |
| **2.** | Programming Manual |
| **3.** | PLC Manual |
| **4.** | Programming Station (Computer) |
| **5.** | Programming and communication adaptors |
| **6.** | Latest HMI designing software |
| **7.** | Electrical tool box |
| **8.** | Special Tools for diagnosis |
| **9.** | PLC Trainer |

## Critical Evidence(s) Required

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

Evidence of the following is essential:

- Develop flowcharts and Pseudo code
- Write a PLC Program using Ladder logic

## 0714E&A92- Install the advance control system

**Overview:**

| Competency Units | Performance Criteria |
|---|---|
| **1. Differentiate Modules of control systems** | P1. Identify the standalone/ module<br>P2. Demonstrate its functions & capabilities<br>P3. Extract information from device part number |
| **2.Install / Modify PLC and its components** | P1. Implement hardware configuration as per given design<br>P2. Perform post installation test<br>P3. Disassemble the hardware in accordance user's manual |
| **3.Install field instruments** | P1. Identify field instruments<br>P2. Install the wiring from Module to instrument location<br>P3. Install the instrument<br>P4. Perform field testing and calibration (if required)<br>P5. Generate the field testing reports |

**Knowledge and understanding**

- Describe different functions & importance of modules
- Describe the correlation of modules
- Describe the safe wiring and layout procedure
- Explain communication topology and their application
- Explain design and part selection as per the requirement of machine.
- Explain different instruments and their wiring.
- Explain hardware configuration
- Explain modular and Standalone design
- Explain offline/online testing procedures
- Explain the data sheets of instruments
- Explain the importance of hardware testing (monitoring, diagnose real time data/faults)
- Explain the module on basis of their specification

**Tools & Equipment**

| SN | |
|---|---|
| **1.** | Datasheets |
| **2.** | Electrical Tester |
| **3.** | Jumper wire set |
| **4.** | Mili-Amp Source |
| **5.** | Multimeter |
| **6.** | Part Manuals |
| **7.** | PLC Trainer |
| **8.** | Pliers |
| **9.** | Power supply |

| | |
|---|---|
| **10.** | Screw driver set |
| **11.** | Spanner set |
| **12.** | Special Tools |
| **13.** | Trainer |

## Critical Evidence(s) Required

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

Evidence of the following is essential:

- Perform field testing and calibration
- Generate field testing report

***Boiler Instrumentation***

## 0714E&A93- Install the boiler control system

**Overview:**
After this competency standard the student will be able to implement, troubleshoot and perform maintenance and diagnostics of boiler instruments and its control system in various industries.

| Competency Units | Performance Criteria |
|---|---|
| **1. Select appropriate fittings and instruments according to requirement** | **P1.** Select appropriate fittings and instruments according to requirement<br>**P2.** Install/remove the orifice plate.<br>**P3.** Perform boiler route/ pipe line testing.<br>**P4.** Identify/remove the hazard that may affect equipment / maintenance personnel during maintenance<br>**P5.** Perform lockout/tag out before starting maintenance work |
| **2. Install the Instruments** | **P1.** Install and calibrate the transmitter<br>**P2.** Remove the transmitter.<br>**P3.** Calibrate the sensor and process variable switches.<br>**P4.** Verify the physical value to the controller value by using specific tools.<br>**P5.** Install/remove/Calibrate the differential pressure transmitter (ΔP).<br>**P6.** Change the operating pressure safety valve (PSV) and Test the operation.<br>**P7.** Demonstrate the working of gas regulator by changing the line pressure as specified.<br>**P8.** Perform UV flame detector maintenance/ alignment/ manual test its functionality<br>**P9.** Install/remove air blower<br>**P10.** Perform manual testing/maintenance of an air blower<br>**P11.** Install/remove ignition transformer for any abnormality<br>**P12.** Visually inspect the electric discharge density and distance/physical condition of electrodes.<br>**P13.** Demonstrate the phenomenon of flow, pressure, temperature compensation. |

**Knowledge and understanding**

- Demonstrate the calibration process of sensors and switches.
- Demonstrate the maintenance practices of motor operated valves (MOV), regulators, air blowers, ignition transformers.
- Knowledge of Boiler Working principle and method.
- Knowledge of the installation and calibration method of Current to Pneumatic (I/P) and Pneumatic to Current (P/I) converters
- Knowledge of types of mounting fittings and their working principles.

- Selection of instruments as per need and environment.
- Understanding of applications of Bernoulli's Theorem.
- Understanding of the heating system and its effectiveness.
- Understanding of the importance and procedure of flow, pressure and temperature compensation.
- Understanding of the installation and calibration method of Pressure, flow and differential Pressure transmitter (ΔP). Also calculation for conversion of ΔP to flow measurement.
- Understanding of the installation of Level and density transmitters/controllers.
- Understanding of the mounting and understanding of pressure and flow gauges with pig-tail siphon.
- Understanding of the selection of digital and analog actuators.
- Understanding of the ventilation system and its importance
- Understanding of the working principles of motor operated valves. (MOV), regulators, air blower, ignition transformers knowledge of their impact on overall operation of a boiler.
- Understanding of use of Orifice plate for fluid and gas.

**Tools & Equipment**

| SN | |
|---|---|
| **1.** | Datasheets |
| **2.** | Digital pressure gauge |
| **3.** | Digital thermometer |
| **4.** | Electrical Tester |
| **5.** | Electrical Tool Box |
| **6.** | Function generator |
| **7.** | Jumper wire set |
| **8.** | Mili-Amp Source |
| **9.** | Multi-Meter |
| **10.** | O&M Manuals |
| **11.** | Part Manuals |
| **12.** | Power supply |
| **13.** | Spanner Set |
| **14.** | Special Tools |
| **15.** | Tagout/lockout tools |
| **16.** | Trainer |

**Critical Evidence(s) Required**

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

Evidence of the following is essential:
- Install and calibrate the transmitter
- Perform boiler route/ pipe line testing

## 0714E&A94- Operate the Boiler System

**Overview**

After the following competency standard, the student will be able to operate, perform operational shutdowns, monitor, analyze and record boiler data in various industry.

| Competency Units | Performance Criteria |
|---|---|
| **1. Prepare the boiler for operation** | P1. Identify Health and safety hazards & report to responsible personnel.<br>P2. Purge the boiler according to workplace procedure<br>P3. Perform pre-operational checks & confirm operational status of boiler and related equipment |
| **2. Start and monitor boiler operation** | P1. Start the boiler safely as per manufacturer's specifications<br>P2. Operate the plant within limits of manufacturer's specifications<br>P3. Monitor the Equipment to confirm operating condition<br>P4. Test the water quality and adjust as required<br>P5. Ensure that the workplace meets housekeeping standards |
| **3. Analyze and respond to abnormal performance** | P1. Analyze operating data and plant operating conditions to identify causes of abnormal performance<br><br>P2. Take corrective action in response to Hazards<br>P3. Implement emergency procedures as required |
| **4. Handover the boiler operations** | P1. Maintain the workplace in accordance with statutory requirements and workplace procedures<br>P2. Carry out Handing over according to workplace procedure |
| **5. Carry out an operational shutdown** | P1. Shut down the boiler according to workplace procedures<br>P2. Identify the maintenance requirements & report according to workplace reporting procedure |
| **6. Prepare the boiler for an internal inspection** | P1. Shut down the boiler according to workplace procedures<br>P2. Clean the boiler is internally and externally according to workplace procedures<br>P3. Remove the valves and fittings<br>P4. Place the boiler in the appropriate storage mode according to manufacturer's recommendations<br>P5. Generate a record report |

**Knowledge and understanding**

- Describe handover status of boiler and associated services which is important in handover
- Describe the Boiler inspection report after shutdown.

- Describe the services associated with boilers
- Explain the boiler system layout and steam/oil cycle
- Explain the importance and procedure of ash removal
- Explain the limitation of a boiler and the process data which need to be monitored
- Explain the parameter which impacts the shutdown.
- Explain the pre-handover procedures/checklist and their impact on overall operation.
- Explain the relationships of process variables and data curves
- Understand the basic working principles of combustion operation
- Understand the cleaning/purging procedure (internal/external) during shutdown
- Understand the data and their operating ranges.
- Understand the importance of PPEs and safe working procedures
- Understand the operation of pumping system, their parameter.
- Understand the operational and emergency shutdown procedure.
- Understand the operational data and its importance
- Understand the procedures for responding to emergency situations including safe shutdown procedure\
- Understand the purpose of purging, efficiency of fuel, tagout/lockout procedures.
- Understand the water quality test procedure.

**Tools & Equipment**

| SN | |
|---|---|
| **1.** | Trainer |
| **2.** | O&M Manuals |
| **3.** | Digital thermometer |
| **4.** | Digital pressure gauge |
| **5.** | Record book |
| **6.** | Tag out / lockout tools |
| **7.** | Special Tools |

**Critical Evidence(s) Required**

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

Evidence of the following is essential:

- Start and monitor boiler operation
- Carry out an operational shutdown

**Entrepreneurship:**

## 0713E&A95 Investigate Micro Business Opportunities

**Overview :**

This competency describes the performance outcomes, skills and knowledge required to develop business ideas, and to investigate market needs and factors affecting potential markets.

| Competency Unit | Performance Criteria |
|---|---|
| CU-1. Describe business ideas | P1. Gather information for business ideas from appropriate sources P2. List details of business ideas and opportunities<br>P3. Research alternative business ideas in light of the resources available<br>P4. Specify and list products and services to match business ideas<br>P5. .Identify and research potential customer information for business ideas<br>P6. Identify and take into account financial, business and technical skills available when researching business opportunities |

| | |
|---|---|
| **CU-2.** Identify market needs | P1. Collect information regarding market size and potential from appropriate sources<br>P2. Investigate market trends and developments to identify market needs relative to business ideas<br>P3. Gather market information from primary and secondary sources to identify possible market needs in relation to business ideas<br>P4. Identify ethical and cultural requirements of the market and their impact on business ideas<br>P5. Identify new and emerging markets and document their features P6. Identify and organise information on expected market growth or decline and associated risk factors |
| **CU-3.** Investigate factors affecting the market | P1. Identify projected changes in population, economic activity and the labour force that may affect business ideas<br>P2. Identify movements in prices and projected changes in availability of resources<br>P3. Review trends and developments and identify their potential impact on business ideas |

Knowledge and understanding

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

- Define entrepreneurship.
- Explain the concept of entrepreneurship
- Explain the various types of enterprise that exist in the community
- Identify and interpret the terms and elements involved in the concept of enterprise
- Appreciate that the advancement of individual and society in general when entrepreneurship is adopted
- Explain various motivational factors that entrepreneurs possess and utilize.
- Exhibit the skills needed to assess and evaluate a risk
- Describe the outline of small enterprise
- Describe the creativity and innovation
- Apply the techniques for developing creative abilities

- Explain the resources of business idea
- Explain the collective and creative thinking
- Explain how to generate a business idea
- Appreciate the importance of, and possess techniques for identifying and assessing business opportunities.
- Identify the various entrepreneurial characteristics
- Access personal potential for becoming future entrepreneurs.
- Identify leadership qualities which are essential to the success of entrepreneurs
- Identify self- management skills and how they are important to be enterprising
- Apply a rational approach to make personal and business decisions
- Explain the steps for decision making and rating of decision making skills
- Apply the rules of negotiation for resolving business issues

Tools and Equipment

| S No. | Tools |
|---|---|
| 1 | Calculator |
| 2 | Ruler |
| 3 | Papers and Pencil |

**Critical Evidence(s) Required**

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

Evidence of the following is essential**:**

•Thorough investigation of business opportunities and ideas

•Clearly identified products/services and customer information for each business idea

•Thorough collection and analysis of market information and associated factors relating to business ideas

•Knowledge of ethical and cultural requirements.

## 0713E&A96 Develop a Micro Business Proposal

**Overview :**

This competency describes the performance outcomes, skills and knowledge required to develop an identified business idea, to research the feasibility of the business opportunity and to present a business idea in formats that suit a range of stakeholders

| Competency Unit | Performance Criteria |
|---|---|
| CU1.Evaluate business opportunities | P1. Identify and research key factors that influence viability of business ideas<br>P2. Analyse business ideas in terms of personal or family needs and commitments<br>P3. Evaluate impacts of emerging or changing technology, including e-commerce, on the business<br>P4. Determine viability of business opportunity in line with perceived risks, resources available, financial returns and other outcomes sought P5. Assess and match personal skills/attributes against those perceived as necessary for a particular business opportunity<br>P6. Identify and assess business risks according to resources available and personal preferences |
| CU2.Detail the business idea | P1. .Develop an accurate description of the business idea for key stakeholders<br>P2. Develop an accurate summary of the major products and/or services required to suit personal needs and requirement |
| CU3.Prepare the business Overview to suit different stakeholders | P1. Present an accurate list of key stakeholders and their information requirements<br>P2. Determine an acceptable method of presentation of information for each stakeholder<br>P3. Provide accurate customised information to target audiences |

Knowledge and understanding

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

- State and local government legislative requirements relating to business operation, especially in regard to occupational health and safety (OHS) and environmental issues,
- Income and expenditure costing •
- Principles of risk assessment relevant to the business opportunity

Tools and Equipment

| S No. | Tools |
|---|---|
| 1 | Calculator |
| 2 | Ruler |
| 3 | Papers and Pencil |

**Critical Evidence(s) Required**

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

Evidence of the following is essential**:**

- accurate and complete outline of the business idea that considers the major elements of**:**
  - products/services
  - customers
  - operations and processes
  - income and expenditure
  - resources
  - marketing
  - location

## 0714E&A97. Develop a Marketing Plan

**Overview :**

This competency describes the performance outcomes, skills and knowledge required to research, develop and present a marketing plan for an entrepreneurship business

| Competency Unit | **Performance Criteria** |
|---|---|

| | | |
|---|---|---|
| **CU-1.** | Devise marketing strategies | P1.Evaluate ***marketing opportunity options*** that address organisational objectives, and evaluate their risks and returns in the selection process<br>P2.Develop ***marketing strategies*** that address strengths and opportunities within the organisation's projected capabilities and resources<br>P3. Develop strategies which increase resources or organisational expertise where gaps exist between current capability and marketing objectives<br>P4.Develop feasible marketing strategies and communicate reasons that justifies their selection<br>P5. Ensure strategies align with organisation's strategic direction<br>P6.Develop a ***marketing performance review strategy***, incorporating appropriate marketing metrics to review of organisational performance against marketing objectives |
| **CU-2.** | Plan marketing tactics | P1. Detail tactics to implement each marketing strategy in terms of scheduling, costing, accountabilities and persons responsible<br>P2. Identify coordination and monitoring mechanisms for scheduled activities<br>P3.Ensure tactics are achievable within organisation's projected capabilities and budget<br>P4. Ensure tactics meeting ***legal and ethical requirements***<br>P5.Ensure tactics provide for ongoing review of performance against objectives and budgets, and allow marketing targets to be adjusted if necessary |
| **CU-3.** | Prepare and present a marketing plan | P1.Ensure marketing plan meets organisational, as well as marketing, objectives and incorporates ***marketing approaches*** and a strategic ***marketing mix***<br>P2. Ensure marketing plan contains a rationale for objectives and information that supports the choice of strategies and tactics<br>P3. Present marketing plan for approval in the required format and timeframe<br>P4. Adjust marketing plan in response to feedback from key stakeholders and disseminate for implementation within the required timeframe |

Knowledge and understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of**:** Culturally appropriate communication skills to relate to people from diverse backgrounds and people with diverse abilities

- Describe the market & marketing
- Differentiate between sellers and buyers' market
- Describe the five 'w' of market
- Explain the procedure for assessing the market size and demand
- Explain the major factors to be considered when selecting a location for a business
- Describe the basic types of business ownership and the limitation of each
- Explain the computation of initial and working capital needed to start an enterprise
- Identify the advantages and disadvantages of using various sources of capital to start an enterprise
- Explain the component of cost of product
- Explain the breakeven analysis for a new business
- Calculate the breakeven point for various new business

Tools and Equipment

| S No. | Tools |
|---|---|
| 1 | Calculator |
| 2 | Ruler |
| 3 | Papers and Pencil |

**Critical Evidence(s) Required**

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

- Devising, documenting and presenting a marketing plan
- Detailing approaches and
- The marketing mix to achieve organisational marketing objectives.

## 0714E&A98 Develop and Review a Business Plan.

**Overview :**

This competency standard covers the process of developing and reviewing business for a small business enterprise. It requires the application of knowledge and skills to determine the scope of the business plan, prepare a business plan, determine goals, trial systems, and document, monitor and review the business plan.

| Competency Unit | Performance Criteria |
|---|---|
| **CU-1.** Determine scope of business | **P1.** Determine scope of the business plan and associated systems is determined in consultation with **specialist personnel.**<br>**P2.** **Access accurate information** for inform business plan development<br>**P3.** **Account for and incorporate trends and seasonal variations** into the business plan.<br>**P4.** **Account for strategic goals, targets and directions** of the enterprise in the development of the business plan<br>**P5.** **Comply Legal obligations** in developing the business plan. |
| **CU-2.** Prepare business plan | **P1.** **Develop operational goals and targets** to meet the enterprise strategic plan.<br>**P2.** **Identify and incorporate supply chains** into the business plan.<br>**P3.** **Identify risk management needs** are within the business plan.<br>**P4.** **Incorporate trial systems** in order to test budgetary impact and operational potential prior to full implementation of the business plan.<br>**P5.** **Set clear and measureable indicators of operational performance** to allow for realistic analysis of performance. |
| **CU-3.** Document and review business plan | **P1.** **Include fiscal and operational systems** that enhance performance management and suit enterprise requirements. |

| | |
|---|---|
| | **P2.** **Incorporate resource considerations** the business plan.<br>**P3.** Document accurately and clearly communicate business Plan to all **relevant parties.**<br>**P4.** **Monitor** to identify strengths, weaknesses and areas for improvement performance against the business plan<br>**P5.** Make recommendations to improve the business plan and associated systems as required. |

Knowledge and understanding

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

- Appreciate the importance of business plan
- Explain the process of writing a business plan
- Develop feasibility for a business idea
- Realize the problem that may be encountered when starting a small business/Enterprise
- Develop a business plan for a small business on the standard format
- Evaluate the business plan in a real market satiation
- The knowledge requirements for this competency standard are listed below**:**
- budgeting
- forecasting
- operational systems
- relevant industrial awards and agreements
- communication techniques
- logical and analytic methods
- profit and loss and cash flow systems
- working knowledge of environmental, OHS, industrial relations, taxation, corporate and industry legislation as they relate to the enterprise

Tools and Equipment

| S | Tools |
|---|---|

| No. | |
|---|---|
| 1 | Construction Lab Tools |
| 2 | Rule,tape, square, hammer, hand saw, hand plane, chisel, shovel, wheelbarrow, sledge hammer, pick, mattock andcrowbar andpinchbarfor given tasks. |

**Critical Evidence(s) Required**

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

The skills and knowledge required to develop and review a business plan must be **transferable** to a different work environment. For example, if competence is demonstrated in developing a business plan for a small enterprise, it must also be evident in reviewing a business plan in medium or large enterprise environment.

## 0714E&A99 Organise Finances for the Micro Business

**Overview :**

This competency standard describes the performance outcomes, skills and knowledge required to investigate the financial capacity to enter into a micro business, to determine the projected cash flow, to source finances and to monitor the profitability of the business.

| Competency Unit | Performance Criteria |
|---|---|
| **CU-1.** Ascertain own financial position and the ability to provide capital/equity for the business | P1. Realistically detail personal, family or community financial situation in terms of funds available and commitments already incurred<br>P2. Determine equity finance and assets available for micro business from personal, family or community sources |
| **CU-2.** Determine projected cash flow for the business | P1. Determine the level of forecast business activity over a year and the business mix<br>P2. Estimate establishment costs for the business and repayment schedule for borrowings<br>P3. Calculate the monthly variable and fixed costs needed to conduct business activity over a year<br>P4. Estimate personal drawings needed to be taken from the business<br>P5.Estimate the monthly income generated by the business for a year based on price per unit item or hourly charge rate for labor<br>P6. Develop a cash flow budget for the first year of business operation<br>P7. Seek professional advice to estimate goods and services tax and operating finance required for the business |
| **CU-3.** Source the required funds to establish the business | P1. Estimate required funding to establish and run the business based on expected sales and activity levels, available finances and commitments<br>P2. Investigate methods of accessing alternative sources of finance |

| | |
|---|---|
| | P3. Identify strategies for meeting financial obligations P4. Implement plans to access available funds as required |
| **CU-4.** Monitor profitability of the business | P1. Maintain and review monthly expenditure and income records<br>P2. Compare equity at beginning and end of a year to estimate business performance<br>P3. Assess the financial viability of the business after a year of operation<br>P4. Seek professional advice on depreciation, insurance and tax implications of the business |

Knowledge and understanding

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

- Basic budgeting
- basic costing for the business
- financial commitments and requirements
- financial reports and terminology
- methods and relative costs of obtaining finance
- own financial position
- Sources of advice and assistance.

**Critical Evidence(s) Required**

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

- investigation of projected cash flow for the business
- estimation of the funding needed to establish and operate the business
- assessment of the financial viability of the business
- Knowledge of basic budgeting.

## 0714E&A100 Manage Human Resources

**Overview :**

This competency standard covers the skills and knowledge required to manage human resources and to manage and develop human resources to achieve organization's operational objectives

| Competency Unit | Performance Criteria |
|---|---|
| **CU-1.** Lead and motivate people | P1.Establish goals for people and teams to optimise achievement in work tasks.<br>P2.Take into account the capabilities of people and teams.<br>P3. Provide advice and support sensitive to the individual's needs to people in the performance of their duties.<br>P4. Undertake activities to achieve commitment to common goals.<br>P5. Recognise and encourage initiative and innovation<br>P6. Recognise and communicate achievements within the organisation. |
| **CU-2.** Undertake human resource planning | ***P1.Determine human resource needs*** within the anticipated operational needs and allocated budget.<br>P2. Analyse alternatives to staffing levels which clearly demonstrate returns to the organisation.<br>P3. Develop contingency plans for staffing which meet key provisions of the human resources plan.<br>P4. Compare existing competencies of staff with the needs of the work group.<br>P5. Plan staffing levels and negotiate with ***stakeholders*** within the organisational framework to achieve maximum efficiency of operations. |
| **CU-3.** Develop and facilitate performance | P1.Negotiate **Performance Criteria** individuals, teams and work groups.<br>P2. Review **Performance Criteria** as circumstances change.<br>P3. Conduct p***erformance appraisal*** based on clearly established and agreed **Performance Criteria**. |

| | |
|---|---|
| | P4.Identify and propose the total performance development system strategies to rectify performance shortfalls and recognise success.<br>P5. Address performance problems confidentially and in a constructive and timely manner, in line with relevant organisational procedures.<br>P6. Make s***elections, transfers and promotions*** in accordance with organisation policies and supported with documented information.<br>P7. Develop and implement mechanisms for the identification of human resource development needs within the work group taking account of the strategic plan for the organisation. |
| **CU-4.** Facilitate training, education and development opportunities | P1.Make information on planned training events widely available throughout the organisation.<br>P2. Include training, education and development plans as part of individual/team performance plans.<br>P3. Facilitate individual/team access to, and participation in, training, education and development opportunities.<br>P4.Contribute coaching and mentoring effectively to the training, education and development of personnel in an environment of change.<br>P5.***Enhance training, education and development opportunities*** of individual, team and organisational performance.<br>P6. Create workplace environment is which facilitates training, education and development |

Knowledge and understanding

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

- Describe the hiring method/Procedures
- Describe the term & conditions of services and job description for various employments
- Describe the characteristics of successful sales personals
- communication principles
- conflict resolution principles and practice
- Equal Employment Opportunity
- grievance procedures
- interpersonal relations
- leadership theory and principles
- management principles and practice
- Occupational Health and Safety
- training and education principles
- training need analysis

**Critical Evidence(s) Required**

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

It is essential that competence be demonstrated in the application of human resource management in a wide range of contexts in achieving the organisation's objectives.

- Evidence should be gathered over a period of time in a range of actual or simulated workplace environments.
- Evidence of competent performance should be obtained by observing an individual in a management role within the workplace or exercise or operational environment. Knowledge may be assessed through written assignments, project reports, debriefings and action learning projects.

## 0714E&A101 Market Products and Services

**Overview :**

This competency standard covers the skills and knowledge required to market products and services

| Competency Unit | Performance Criteria |
|---|---|
| **CU-1.** Analyze market information | P1. Identify, research and analyse existing or new markets for existing or new products or services using techniques to ensure reliable data<br>P2. Analyse past trends and developments to determine market variability and associated risks<br>P3. Develop gross margin budgets to account for market variability<br>P4.Identify and evaluate competing products to determine strengths and weaknesses of own products<br>P5. Monitor market environment to ensure information is current and reliable<br>P6. Identify the legal, ethical and environmental constraints of the markets and their effect on the enterprise<br>P7. Identify product specifications that suit market requirements and price advantage at the time<br>P8. Present clear and concise information to the enterprise management team. |
| **CU-2.** Identify and evaluate factors to include in a marketing plan | P1. Identify and evaluate production processes to ensure required product specifications are met<br>P2. Identify and assess alternative selling strategies and techniques to identify marketing targets and methods<br>P3. Identify and assess distribution channels and their role in your marketing strategies<br>P4. Ensure the data used is reliable and the market environment and trends are substantiated<br>P5. Evaluate the role of marketing professionals in providing advice |
| **CU-3.** Develop a | P1. Establish marketing objectives based on current and |

| | | |
|---|---|---|
| | marketing plan for your products and services | potential product specifications<br>P2. Select appropriate production processes to ensure product specifications are met<br>P3. Select selling strategies to ensure required prices are achieved<br>P4. Select appropriate distribution channel options to ensure access to target markets is achieved efficiently and appropriately<br>P5. Establish time-frames for production, distribution and selling activities<br>P6. Develop a gross margin budget to demonstrate the cost effectiveness of the marketing plan<br>P7. Develop partial gross margin budgets to account for market variability |
| **CU-4.** | Determine promotional strategies | P1. Prepare and record detailed plans for promotional activities<br>P2. Outline objectives, level of exposure and available markets<br>P3. Ensure strategies take account of time management and scheduling issues, and resource constraints<br>P4. Create promotional materials that enhance the product and commercial presentation<br>P5. Record and communicate priorities, responsibilities, timelines and budgets for promotional activities. |
| **CU-5.** | Implement marketing activities | P1. Schedule planned marketing activities within appropriate timeframes<br>P2. Develop measurable performance targets that meet business plan objectives<br>P3. Organise distribution channels and ensure product and service information is accurate and readily available to clients<br>P4. Implement marketing activities within budgetary constraints to meet legal, ethical and enterprise requirements |
| **CU-6.** | Evaluate | P1. Review the established marketing objectives to ensure |

| | |
|---|---|
| marketing performance. | they remain viable<br>P2. Make an objective assessment of the marketing plan and its implementation by a comparison of valid and reliable data against the established objectives<br>P3.Assess product, pricing and distribution policies in relation to market changes, marketing objectives and enterprise requirements<br>P4. Identify areas of positive marketing performance and take corrective action to remedy poor marketing performance areas<br>P5. Document and distribute information for continual analysis and effective planning management |

Knowledge and understanding

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

- Describe the life cycle of product
- Identify the various ways of selecting suppliers,
- Explain the inventory management of stock, raw material and finished goods etc.
- Appreciate the importance of financial record keeping in a small business
- Explain techniques to keep cost as low as possible
- Develop balance sheet for a small enterprise
- Explain the operating cycle concept
- Explain the income tax computation procedure for a small business
- Explain the basic scheme of sales tax
- Explain the assessment procedure for returns and filling of returns.

**Critical Evidence(s) Required**

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

- Handle and set Lightening for Current affair program
- identify the marketable features of the product and potential markets
- develop a range of marketing alternatives
- collect and analyses data to assess alternatives in a marketing plan
- evaluate performance targets and recommend modifications or improvements
- implement and evaluate a marketing plan
- Plan to manage promotional activities.

## 0714E&A102 Monitor and Review Business Performance

**Overview :**

This competency standard covers the skills and knowledge required tomonitor and review business performance

| Competency Unit | Performance Criteria |
|---|---|
| **CU-1.** Evaluate commercial performance | P1. Gather and analyse data relating to enterprise performance to identify historical and current performance.<br>P2. Review and analyse operational structures to determine the suitability of organisational processes to enterprise objectives.<br>P3. Evaluate enterprise strengths and weaknesses against market conditions to determine current and future capacities.<br>P4. Evaluate enterprise objectives are to identify variations and scope for future development. |
| **CU-2.** Allocate and co-ordinate business resources | P1. Identify and communicate roles and responsibilities of personnel.<br>P2. Identify resource requirements for enterprise and cost them using standard financial analysis techniques.<br>P3. Calculate costs of ensuring sustainability of enterprise operations and factor into business planning for the enterprise. |
| **CU-3.** Identify performance requirements | **P1.** Develop realistic performance indicators within available timeframes and resources<br>**P2.** Identify and minimize factors inhibiting performance against objectives.<br>**P3.** Monitor and assess market conditions based on relevant data.<br>**P4.** Prepare and incorporate strategies and programs to promote the sustainability of operations into enterprise procedures. |

| | |
|---|---|
| **CU-4.** Review business performance | **P1.** Review regularly enterprise operations to identify opportunities for improvements in performance.<br>**P2.** Monitor and anticipate impact of natural conditions on enterprise to assess sustainability of resource use.<br>**P3.** Compare costs and estimates with resource allocation.<br>**P4.** Determine operational plans to determine schedule of activities |

Knowledge and understanding

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

- rates of return for products and/or services
- financial analysis techniques
- structure and operation of small businesses relevant State/Territory Occupational Health and Safety (OHS)
- legislative requirements
- environmental conditions, positive environmental practices and negative impact minimisation measures
- human resource requirements for the enterprise
- transport requirements for the enterprise
- Enterprise/property improvement requirements.
- market performance in commodities
- statutory marketing requirements

**Critical Evidence(s) Required**

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

- review operational structures to determine effectiveness
- identify available resources to assess capacity
- develop realistic performance indicators
- review enterprise operations against performance indicators
- Plan to improve business performance by addressing results of review.

## 0714E&A103 Negotiate for Resolving Business Issues

**Overview :**

This competency standard covers the skills and knowledge required to negotiate for resolving business issues

| Competency Unit | Performance Criteria |
|---|---|
| **CU-1.** Develop and implement issue resolution and grievance procedures | P1. Establish problem solving/issue resolution procedures within legislative requirements and organisation's guidelines.<br>P2. Manage grievances and complaints are in a timely and caring way to optimise likelihood of a favourable outcome for all parties and in line with organisational objectives and procedures.<br>P3.Document and communicate individual's rights and obligations under industrial awards/agreements and legislation are in a clear and concise manner and in appropriate language.<br>P4. Conduct hearings, interviews and meetings within the principles of industrial democracy and participative, consultative processes.<br>P5. Identify and invite all relevant industrial parties to participate in the resolution process. |
| **CU-2.** Manage disciplinary matters | ***P1.Implement disciplinary matters*** in accordance with organisation's procedures.<br>P2. Conduct investigations in a caring and confidential manner to maintain performance and morale.<br>P3. Provide feedback promptly.<br>P4.Institute appeals processes in accordance with organisational procedures.<br>P5. Recognize and recommend deficiencies in procedures for changes made |

Knowledge and understanding

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

- Communication Skills
- Interpersonal skills
- Business letter writing
- Forecasting techniques

## 0714E&104 Manage Personal Finances

**Overview :**

This unit of competency describes the outcomes required to develop, implement and monitor a personal budget in order to plan regular savings and manage debt effectively.

| Unit of Competency | | Performance Criteria | |
|---|---|---|---|
| **CU1** | Develop a personal budget | **P1** | Calculate current living expenses using available information to prepare a personal budget. |
| | | **P2** | Keep a record of all income and expenses for a short period of time to help estimate ongoing expenses. |
| | | **P3** | Subtract total expenses from total income to determine a surplus or deficit budget for the specified period. |
| | | **P4** | Find reasons for a deficit budget and ways to reduce expenditure identified. |
| | | **P5** | Identify ways to increase income, if possible |
| **CU2** | Develop longer term personal budget | **P1** | Analyze income and expenditure and set longer term personal, work and financial goals. |
| | | **P2** | Develop a longer-term budget based on the outcomes of short-term budgeting, and adjust to meet living, work and future career requirements. |
| | | **P3** | Identify obstacles that might affect finances such as job loss, sickness or unexpected expenses contingency savings |
| | | **P4** | Formulate a regular savings plan based on budget, using secure savings products and services. |
| | | **P5** | Monitor expenditure against budget and identify areas of possible expenditure saving |
| **CU3** | Identify ways to maximize | **P1** | Determine sources and ways to maximize personal income, including from work, |

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| future finances | investments or available government payments/allowances.<br>**P2** Get further education or training to maintain or improve future income.<br>**P3** Identify the need for debt to finance living and other expenses, and determine the appropriate levels of debt and repayment.<br>**P4** Consolidate existing debt, where possible, to minimize interest costs and fees.<br>**P5** Seek professional money management services, where available, to ensure financial plans are effective and achievable. |

Knowledge and 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**:**

- .Explain the abilities to plan and organize to keep records and monitor a personal budget
- .Describe abilities to set and review goals
- Explain basic financial management and record keeping to enable development and management of a personal budget
- Describe benefits of financial goal setting and personal budgeting to enable effective management of personal finances
- Outline numeracy skills to compare income and expenditure

## Critical Evidence(s) Required

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

A person who demonstrates competency in this unit must be able to provide evidence of the ability to manage personal finances. The evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

Performance requirements

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Demonstrated evidence is required of the ability to**:**

- develop a personal budget based on analysis of expenditure and income;
- formulate goals and identify financial contingency plans; and
- Monitor expenditure for a period of up to 2 weeks

## 0714E&A105 Coordinate a Work Team

**Overview :**

This unit is concerned with the competencies required to achieve operational outcomes and effective working relationships through managing and developing individuals and teams.

| Unit of Competency | Performance Criteria |
|---|---|
| **CU1** Develop and maintain a cooperative work group | **P1** Work contributions and suggestions from staff are<br>**P2** continually sought and encouraged<br>**P3** Contributions to work group operations are acknowledged and suggestions are dealt with constructively<br>**P4** Develop staff skills according to work requirements<br>**P5** Implement new work practices<br>**P6** Address conflict between staff members in accordance with current personnel practices. |
| **CU2** Communicate objectives and required standards | **P1** Inform the staff of the objectives and standards<br>**P2** required<br>**P3** Commit to objectives and standards<br>**P4** Practices of safe, fair and participative work principals are and promote to staff |
| Provide feedback on performance | **P1** Give constructive feedback on all aspects of work performance provided to individuals and team<br>**P2** Access and address performance in a fair and timely manner in accordance with relevant guidelines, procedures and natural justice |
| **CU3** Support and participate in development | **P1** Assess training needs of all staff, implemented and promoted<br>**P2** Devise an action plan to meet individual |

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| activities | and group training<br>**P3** and development needs is collaboratively developed,<br>**P4** agreed to and implemented<br>**P5** Identify specific training needs of individuals<br>**P6** Encourage staff in applying skills and knowledge in the workplace<br>**P7** Provide training to the required standard on the job<br>**P8** Support and encourage staff to attend training courses and to take up other development opportunities. |
| **CU4** Provide leadership. direction and guidance to the work group | **P1** Link between the function of the group and the<br>**P2** goals of the organization<br>**P3** Participate in decision making routinely to develop, implement and review work of the group and to allocate responsibilities where appropriate<br>**P4** Give opportunities and encouragement to others to develop new and innovative work practices and strategies<br>**P5** Identify conflict and resolve with minimum disruption to work group function<br>**P6** Provide staff with the support and supervision necessary to perform work safely and without risk to health<br>**P7** Allocate tasks within the competence of staff and support with appropriate authority, autonomy and training<br>**P8** Supervise appropriately the changing priorities and situations and takes into account the different needs of individuals and the requirements of the task |

Knowledge and understanding

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

- Explain the principles of effective team operation
- Explain the principles of human resource management
- Describe the training delivery processes in the workplace
- Outline the industry assessment guidelines

**Critical Evidence(s) Required**

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

A person who demonstrates competency in this unit must be able to provide evidence of the ability to coordinate a work team. The evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

Performance requirements

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Evidence of the following is essential**:**

- assessing and evaluating skills
- working effectively in a team environment
- achievement of work outcomes

## 0714E&E106 Lead Small Teams

**Overview :**

This unit describes the outcomes required to lead small teams including setting and maintaining team and individual performance standards

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| Unit of Competency | Performance Criteria |
|---|---|
| **CU1** Facilitate team Development | **P1** Identify work requirements, standards and purpose to team members.<br>**P2** Assist team to develop objectives, targets and key performance indicators relevant its purpose and workplace goals.<br>**P3** Allocate duties regard to the skills required to properly<br>**P4** undertake the assigned task and according to company policy<br>**P5** Identify roles, responsibilities and expectations of each team member<br>**P6** Disseminate and discuss performance expectations to individual team members. |
| **CU2** Motivate and build the Team | **P1** Develop positive and constructive relationships with and between team members<br>**P2** Facilitate team communication processes<br>**P3** Involve team members in the process of examining risks and options and making decisions, to ensure acceptance and support.<br>**P4** Encourage individual and team efforts and contributions<br>**P5** Strengths and weaknesses of team members are determined and sharing of work tasks is promoted to up skill team members.<br>**P6** Recognize team members' queries and discuss and deal with it. |
| **CU3** Facilitate | **P7** Monitor the implementation of work plan and |

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| and monitor team effectiveness | team and individual performance against agreed strategies, targets and standards, according to workplace policies and procedures.<br>**P1** Monitor performance against defined **Performance Criteria** and/or assignment instructions and corrective action taken if required.<br>**P2** Support team in identifying and resolving problems that may impede performance and to suggest improvements in team Performance.<br>**P3** Consult team members in any review and revision of team objectives and goals.<br>**P4** Address performance issues which cannot be rectified within the team to appropriate personnel according to employer policy.<br>**P5** Refer concerns of a team and individual are referred to next level of management or appropriate specialist and conduct negotiations on their behalf.<br>**P6** Keep team members inform of any changes in the priority allocated to assignments, or tasks which might impact on client/customer needs and satisfaction.<br>**P7** Monitor team operations to ensure that internal or external employer/client needs and requirements are met.<br>**P8** Provide follow-up communication on all issues affecting the team<br>**P9** Conduct team meetings to review work operations and address issues according to workplace policies and procedures.<br>**P10** Support team in identifying and resolving problems that may impede performance and to suggest improvements in team performance.<br>**P11** Consult team members in any review and |

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| | revision of team objectives and goals.<br>**P12** Raise any inappropriate values and standards exhibited in the workplace with the person concerned. |

Knowledge and understanding

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

- Explain conflict resolution techniques
- Explain management styles
- Describe methods of monitoring performance
- Outline the relevant legal requirements
- Outline strategies for dealing effectively with team member complaints or grievances and
- Explain team dynamics and facilitation processes
- Describe communication skills
- State workplace policies and procedures

**Critical Evidence(s) Required**

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

A person who demonstrates competency in this unit must be able to provide evidence of the ability to lead small teams. The evidence should integrate employability skills with workplace tasks and job roles and verify competency is able to be transferred to other circumstances and environments.

Performance requirements

This competency is to be assessed using standard and authorized work practices, safety requirements and environmental constraints. Evidence of the following is essential**:**

- demonstrate the ability to build positive team spirit and effectively manage overall team

- performance within a workplace context;
- demonstrate the ability to coordinate a work team in a range of contexts or occasions; and
- Show knowledge of leadership, motivation and teamwork principles.

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Islamabad 31st May, 2019

**NOTIFICATION**

**No. F. 5(13)/2018-DD (TE):** In pursuance of sub-section (d) of section-6" Functions of the Commission" National Vocational & Technical Training Commission (NAVTTC) Act-2011, NAVTTC is pleased to approve and notify following qualifications in twenty (20) trades for Level 1-5 under National Vocational Qualification Framework (NVQF), which have been developed in compatibility with latest global trends in the fields and fulfilling requirements of competency based training and assessment (CBT&A) system. The qualifications have been developed and validated in collaboration with TEVTAs, QABs, industry and other relevant stakeholders: -

| S# | National Vocational Qualifications |
|---|---|
| 1. | National Qualification Level-5 diploma in Automobile Technology |
| 2. | National Qualification Level-5 diploma in Civil Technology |
| 3. | National Qualification Level-5 diploma in Construction Technology |
| 4. | National Qualification Level-5 diploma in Information & Commutation Technology (ICT) |
| 5. | National Qualification Level-5 diploma in Garment Manufacturing Technology |
| 6. | National Qualification Level-5 diploma in Electrical Technology |
| 7. | National Qualification Level-5 diploma in Electronics Technology |
| 8. | National Qualification Level-5 diploma in Instrumentation Technology |
| 9. | National Qualification Level-5 diploma in Computer Aided Design & Manufacturing (CAD /CAM) |
| 10. | National Qualification Level-5 diploma in Mechanical Technology |
| 11. | National Qualification Level-5 diploma in Graphics Designing |
| 12. | National Qualification Level-5 diploma in Heating, Ventilation, Air-conditioning & Refrigeration (HVACR) Technology |
| 13. | National Qualification Level-5 diploma in Media Production |
| 14. | National Qualification Level-5 diploma in Hotel Management |
| 15. | National Qualification Level-5 diploma in Professional Chef |
| 16. | National Qualification Level-5 diploma in Tourism Management |
| 17. | National Qualification Level-5 diploma in Hair & Beauty Services |
| 18. | National Qualification Level-5 diploma in Fashion Designing |
| 19. | National Qualification Level-5 diploma in Ceramics Technology |
| 20. | National Qualification Level-5 diploma in Telecom Technology |

2. All the TVET related institutions / organizations are required to implement aforementioned qualifications so that a uniform and standardized TVET qualification system is established in Pakistan and efforts are made for international equivalence / recognition of these qualifications.

3. Competency Standards of the above enlisted qualifications can be accessed at NAVTTC's website **(www.navttc.org).**

**(Muqeem Islam)**
Director General (Skill Standards & Curricula)
Phone: 051-9215385

**Distribution:**

1. Federal Secretary, Ministry of Federal Education & Professional Training, Govt of Pakistan
2. Federal Secretary, Ministry of Overseas Pakistanis and Human Resource Development, Govt of Pakistan, Islamabad
3. Federal Secretary, Ministry of Industry and Production, Govt of Pakistan, Islamabad
4. Federal Secretary, Ministry of Textile Industry, Govt of Pakistan, Islamabad
5. Federal Secretary, Ministry of Commerce, Govt of Pakistan, Islamabad
6. Federal Secretary, Ministry of Railway, Govt of Pakistan, Islamabad
7. Federal Secretary, Ministry of Climate Change, Govt of Pakistan, Islamabad
8. Federal Secretary, Ministry of Religious Affairs, Govt of Pakistan, Islamabad
9. Federal Secretary, Ministry of Communication, Govt of Pakistan, Islamabad
10. Federal Secretary, Ministry of Aviation Division, Govt of Pakistan, Islamabad
11. Federal Secretary, Ministry of Science & Technology, Govt of Pakistan, Islamabad
12. Chairperson, Punjab Technical Education and Vocational Training Authority (P-TEVTA), Lahore
13. Managing Director, Khyber Pakhtunkhwa Technical Education and Vocational Training Authority (KP-TEVTA),
14. Managing Director, Sindh Technical Education and Vocational Training Authority (S-TEVTA), Karachi
15. Chairman, Azad Jammu & Kashmir, Technical Education and Vocational Training Authority (AJ&K TEVTA), Muzafarabad
16. Director TVET Cell, Gilgit Baltistan, Gilgit

17. Director General, Punjab Vocational Training Council (PVTC), Punjab
18. Managing Director, Technology Upgradation and Skill Development Company (TUSDEC) Lahore
19. Project Director, Punjab Skill Development Program (PSDP) Lahore
20. CEO, Punjab Skill Development Fund, Lahore
21. Rector, UNTECH University Islamabad
22. National Deputy Leader, GIZ Islamabad
23. PS to Minister of Federal Education & Professional Training, Govt of Pakistan
24. PS to Special Adviser to the Prime Minister on Youth Affairs, Prime Minister's Office, Islamabad
25. Chairperson, Federal of Pakistan Chamber of Commerce and Industry (FPCCI), Karachi
26. Conveyor, Sector Skills Council (Textile/ Construction/ Renewable Energy/ Hospitality and Tourism)
27. Director Technical Education and Vocational Training Authorities (TEVTA), Balochistan
28. Chairman, Pakistan Tourism Development Corporation, Lahore
29. Chairman, PCSIR Headquarters, Islamabad
30. Director General, Pakistan Forest Institute, Peshawar
31. Chairman, Wafaq ul Madaris, Multan
32. Director General, Staff Welfare, Islamabad
33. Director General, NISTE Capital Administration and Development Division, Islamabad
34. Director General, National Training Bureau, Islamabad
35. Chairmen, Provincial Technical Education Boards
36. Chairmen, Provincial Trade Testing Boards
37. Secretary, IBCC, Islamabad: *with the request that National qualifications of Level 5 diploma in the aforementioned trades may be considered equivalent to Diploma of Associate Engineer/HSSC after inclusion of compulsory courses in the light of IBCC general requirement.*

**Copy for information to: -**

1. DG (P&D)/(A&F)/ (A&C) (S&C) NAVTTC
2. Director General(s), NAVTTC Regional Office(s).
3. Sr. Technical Advisor, TSSP-GIZ
4. Staff Officer to Chairman, NAVTTC
5. PS to Executive Director, NAVTTC Islamabad
6. Concerned File/ Office Copy