

**TVET CURRICULUM DEVELOPMENT, ASSESSMENT AND CERTIFICATION COUNCIL (TVET CDACC)**

**COMPETENCY BASED CURRICULUM**

**FOR**

**TELECOMMUNICATION ENGINEERING**

**LEVEL 6**



TVET CDACC

P.O BOX 15745-00100

NAIROBI

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# FOREWORD

The provision of quality education and training is fundamental to the Government’s overall strategy for social economic development. Quality education and training will contribute to achievement of Kenya’s development blue print and sustainable development goals.

Reforms in the education sector are necessary for the achievement of Kenya Vision 2030 and meeting the provisions of the Constitution of Kenya 2010. The education sector had to be aligned to the Constitution and this resulted to the formulation of the Policy Framework for Reforming Education and Training (Sessional Paper No. 4 of 2016). A key feature of this policy is the radical change in the design and delivery of the TVET training. This policy document requires that training in TVET be competency based, curriculum development be industry led, certification be based on demonstration of competence and mode of delivery allows for multiple entry and exit in TVET programmes.

These reforms demand that Industry takes a leading role in curriculum development to ensure the curriculum addresses its competence needs. It is against this background that this Curriculum has been developed.

It is my conviction that this curriculum will play a great role towards development of competent human resource for the Telecommunicatio sector’s growth and sustainable development.

**PRINCIPAL SECRETARY, VOCATIONAL AND TECHNICAL TRAINING**

**MINISTRY OF EDUCATION**

# PREFACE

Kenya Vision 2030 aims to transform the country into a newly industrializing, “middle-income country providing a high-quality life to all its citizens by the year 2030”. Kenya intends to create a globally competitive and adaptive human resource base to meet the requirements of a rapidly industrializing economy through life-long education and training. TVET has a responsibility of facilitating the process of inculcating knowledge, skills and attitudes necessary for catapulting the nation to a globally competitive country, hence the paradigm shift to embrace Competency Based Education and Training (CBET).

The Technical and Vocational Education and Training Act No. 29 of 2013 on Reforming Education and Training in Kenya, emphasized the need toreform curriculum development, assessment and certification. This called for a shift to CBET to address the mismatch between skills acquired through training and skills needed by industry as well as increase the global competitiveness of Kenyan labour force.

TVET Curriculum Development, Assessment and Certification Council (TVET CDACC), in conjunction with Telecommunication Engineering Sector Skills Advisory Committee (SSAC) have developed this curriculum.

This curriculum is designed and organized with an outline of learning outcomes; suggested delivery methods, training/learning resources and methods of assessing the trainee’s achievement. The curriculum is competency-based and allows multiple entry and exit to the course.

I am grateful to the Council Members, Council Secretariat, Telecommunication Engineering SSAC, expert workers and all those who participated in the development of this curriculum.

**Prof. CHARLES M. M. ONDIEKI, PhD, FIET (K), Con. Eng. Tech. CHAIRMAN, TVET CDACC**

# ACKNOWLEDGEMENT

This curriculum has been designed for competency-based training and has independent units of learning that allows the trainee flexibility in entry and exit. In developing the curriculum, significant involvement and support was received from various organizations.

I recognize with appreciation the role of the Telecommunication Engineering Sector Skills Advisory Committee (SSAC) in ensuring that competencies required by the industry are addressed in the curriculum. I also thank all stakeholders in Telecommunication Engineering sector for their valuable input and all those who participated in the process of developing this curriculum.

I am convinced that this curriculum will go a long way in ensuring that workers in Telecommunication Sector acquire competencies that will enable them to perform their work more efficiently.

**DR. LAWRENCE GUANTAI M’ITONGA, PhD**

**COUNCIL SECRETARY/CEO**

**TVET CDACC**

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ACRONYMNS AND ABBREVIATIONS

KEBS Kenya Bureau of Standards

TLE Telecommunication

CU Curriculum

A Control version

BC Basic Competencies

CR Core Competencies

ENG Engineering

KP Kenya Power

CA Communication Authority

NCA National Construction Authority

OSHA Occupational Safety and Health Act

IEE Institute of Electrical Engineers

WIBA Work injury benefits Act

CCTV Closed Circuit Tele Vision

EHS Environment, Health and Safety

CAD Computer Aided Design

CDACC Curriculum Development, Assessment and Certification Council

HVAC Heating, Ventilation and Air Conditioning

IBMS Integrated Building Management System

PPE Personal Protective Equipment

TVET Technical and Vocational Education and Training

SSAC Sector Skill Advisory Committee

**KEY TO UNIT CODE**

ENG/CU/TLE/BC/01/6/A

Industry or sector

Curriculum

Occupational area

Type of competency

Competency number

Competency level

Version control

# OVERVIEW

**Description of the course**

This course is designed to equip Telecommunication technicians with the competencies required to perform various telecommunication duties as stipulated in this curriculum

The course consists of basic, common and core units of learning as indicated below:

**Basic Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit Factors** |
| ENG/CU/TLE/BC/01/6/A | Communication skills | 40 | 4 |
| ENG/CU/TLE/BC/02/6/A | Digital literacy | 60 | 6 |
| ENG/CU/TLE/BC/03/6/A | Entrepreneurial skills | 100 | 10 |
| ENG/CU/TLE/BC/04/6/A | Employability skills | 80 | 8 |
| ENG/CU/TLE/BC/05/6/A | Environmental literacy | 40 | 4 |
| ENG/CU/TLE/BC/06/6/A | Occupational safety and health practices | 40 | 4 |
| **Total** | | **360** | **36** |

**Common Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit Factors** |
| ENG/CU/TLE/CC/01/6/A | Engineering Mathematics | 90 | 9 |
| ENG/CU/TLE/CC/02/6/A | Electrical principles | 80 | 8 |
| ENG/CU/TLE/CC/03/6/A | Workshop Technology | 60 | 6 |
| ENG/CU/TLE/CC/04/6/A | Technical Drawing | 70 | 7 |
| ENG/CU/TLE/CC/05/6/A | Electronics | 70 | 7 |
| **Total** | | **370** | **37** |

**Core Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit Factors** |
| ENG/CU/TLE/CR/01/6/A | Electrical Installation | 70 | 7 |
| ENG/CU/TLE/CR/02/6/A | Installation of Base Transceiver station | 100 | 100 |
| ENG/CU/TLE/CR/03/6/A | Installation of Satellite Signal Reflectors | 70 | 7 |
| ENG/CU/TLE/CR/04/6/A | Security system Installation | 60 | 6 |
| ENG/CU/TLE/CR/05/6/A | Installation of Inside plant Network | 90 | 9 |
| ENG/CU/TLE/CR/06/6/A | Installation of IP PABX | 85 | 8.5 |
| ENG/CU/TLE/CR/07/6/A | Installation of Fibre Optic cables | 80 | 8 |
| ENG/CU/TLE/CR/08/6/A | Installation of communication Equipment | 90 | 9 |
| ENG/CU/TLE/CR/09/6/A | Installation of Radar Systems | 110 | 11 |
| ENG/CU/TLE/CR/10/6/A | Installation of Broadcasting monitor | 85 | 8.5 |
| ENG/CU/TLE/CR/11/6/A | Installation of Telephone network | 70 | 7 |
| ENG/CU/TLE/CR/12/6/A | TV and Radio signal Broadcast | 90 | 9 |
| ENG/CU/TLE/CR/13/6/A | TCP-IP and Networking | 80 | 8 |
| ENG/CU/TLE/CR/14/6/A | Maintenance of Telecommunication Equipment and systems | 70 | 7 |
| ENG/CU/TLE/CR/15/6/A | Telecommunication project management | 60 | 6 |
| ENG/CU/TLE/CR/16/6/A | Installation of Telecommunication transmission Equipment | 100 | 10 |
| ENG/CU/TLE/CR/17/6/A | Installation of WI-FI network | 90 | 9 |
|  | Industrial Attachment | 480 | 48 |
| **Total** | | **1,880** | **188** |
| **Grand Total** | | **2,610** | **261** |

The core units of learning are independent of each other and may be taken independently.

The total duration of the course is **2,610 hours** (87 weeks at 30 hours per week) inclusive of industrial attachment.

1. **Entry Requirements**

An individual entering this course should have any of the following minimum requirements:

1. Kenya Certificate of Secondary Education (K.C.S.E.) with a minimum mean grade of C- (C minus)

**Or**

1. Level 5 certificate in a related course with **one** year of continuous work experience

**Or**

1. Equivalent qualifications as determined by Kenya National Qualifications Authority (KNQA)
2. **Industrial attachment**

An individual enrolled in this course will be required to undergo an industrial attachment in a Telecommunication firm for a period of at least 480 hours. Attachment will be undertaken upon completion of the course or the unit of learning.

1. **Assessment**

The course will be assessed at two levels: internally and externally. Internal assessment is continuous and is conducted by the trainer who is monitored by an internal accredited verifier while external assessment is the responsibility of TVET/CDACC.

1. **Certification**

A candidate will be issued with a Certificate of competency in a unit of competency. To attain the qualification Telecommunication technician Level 6, the candidate must demonstrate competence in all the units of competency as given in qualification pack. These certificates will be issued by TVET CDACC in conjunction with training provider.

# BASIC UNITS OF LEARNING

# COMMUNICATION SKILLS

**UNIT CODE:** ENG/CU/TLE/BC/01/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Demonstrate communication skills

**Duration of Unit:** 40 hours

**Unit Description**

This unit covers the competencies required in meeting communication needs of clients and colleagues and developing, establishing, maintaining communication pathways and strategies. It also covers competencies for conducting interview, facilitating group discussion and representing the organization in various forums.

**Summary of Learning Outcomes**

1. Meet communication needs of clients and colleagues
2. Develop communication strategies
3. Establish and maintain communication pathways
4. Promote use of communication strategies
5. Conduct interview
6. Facilitate group discussion
7. Represent the organization

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Meet communication needs of clients and colleagues | * Communication process * Modes of communication * Medium of communication * Effective communication * Barriers to communication * Flow of communication * Sources of information * Organizational policies * Organization requirements for written and electronic communication methods * Report writing * Effective questioning techniques (clarifying and probing) * Workplace etiquette * Ethical work practices in handling communication * Active listening * Feedback * Interpretation * Flexibility in communication * Types of communication strategies * Elements of communication strategy | * Interview * Written |
| 1. Develop communication strategies | * Dynamics of groups * Styles of group leadership * Openness and flexibility in communication * Communication skills relevant to client groups | * Interview * Written |
| 1. Establish and maintain communication pathways | * Types of communication pathways | * Interview * Written |
| 1. Promote use of communication strategies | * Application of elements of communication strategies * Effective communication techniques | * Interview * Written |
| 1. Conduct interview | * Types of interview * Establishing rapport * Facilitating resolution of issues * Developing action plans | * Interview * Written |
| 1. Facilitate group discussion | * Identification of communication needs * Dynamics of groups * Styles of group leadership * Presentation of information * Encouraging group members participation * Evaluating group communication strategies | * Interview * Written |
| 1. Represent the organization | * Presentation techniques * Development of a presentation * Multi-media utilization in presentation * Communication skills relevant to client groups | * Interview * Written |

**Suggested Delivery Methods**

* Discussion
* Role playing
* Simulation
* Direct instruction
* Practice by trainee

**Recommended Resources**

* Desktop computers/laptops
* Internet connection
* Projectors
* Telephone

# 

# DIGITAL LITERACY

**UNIT CODE:** ENG/CU/TLE/BC/02/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate digital literacy

**Duration of Unit:** 60 hours

**Unit Description**

This unit describes competencies required to use a computer and other digital devices for the purposes of communication, work performance and management at the workplace.

**Summary of Learning Outcomes**

1. Identify computer software and hardware
2. Apply security measures to data, hardware, software in automated environment
3. Apply computer software in solving tasks
4. Apply internet and email in communication at workplace
5. Apply desktop publishing in official assignments
6. Prepare presentation packages

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Identify computer hardware and software | * Concepts of ICT * Functions of ICT * History of computers * Components of a computer * Classification of computers | * Written tests * Oral presentation * Observation |
| 1. Apply security measures to data, hardware and software | * Data security and control * Security threats and control measures * Types of computer crimes * Detection and protection against computer crimes * Laws governing protection of ICT | * Written tests * Oral presentation * Observation * Project |
| 1. Apply computer software in solving tasks | * Operating system * Word processing * Spread sheets * Data base design and manipulation * Data manipulation, storage and retrieval | * Oral questioning * Observation * Project |
| 1. Apply internet and email in communication at workplace | * Computer networks * Network configurations * Uses of internet * Electronic mail (e-mail) concept | * Oral questioning * Observation * Oral presentation * Written report |
| 1. Apply desktop publishing in official assignments | * Concept of desktop publishing * Opening publication window * Identifying different tools and tool bars * Determining page layout * Opening, saving and closing files * Drawing various shapes using DTP * Using colour pellets to enhance a document * Inserting text frames * Importing and exporting text * Object linking and embedding * Designing of various publications * Printing of various publications | * Oral questioning * Observation * Oral presentation * Written report * Project |
| 1. Prepare presentation packages | * Types of presentation packages * Procedure of creating slides * Formatting slides * Presentation of slides * Procedure for editing objects | * Oral questioning * Observation * Oral presentation * Written report * Project |

**Suggested Delivery Methods**

* Instructor led facilitation of theory
* Demonstration by trainer
* Practical work by trainee
* Viewing of related videos
* Project
* Group discussions

**Recommended Resources**

* Desk top computers
* Laptop computers
* Other digital devices
* Printers
* Storage devices
* Internet access
* Computer software

# ENTREPRENEURSHIP EDUCATION

**UNIT CODE:** ENG/CU/TLE/BC/03/6/A

**Relationship to occupational standards**

This unit addresses the unit of competency: Demonstrate understanding entrepreneurship

**Duration of unit:** 100 hours

**Unit description**

This unit covers the competencies required to demonstrate understanding of entrepreneurship. It involves demonstrating understanding of an entrepreneur, entrepreneurship and self-employment. It also involves identifying entrepreneurship opportunities, creating entrepreneurial awareness, applying entrepreneurial motivation and developing business innovative strategies.

**Summary of Learning Outcomes**

* 1. Demonstrate understanding of an entrepreneur
  2. Demonstrate knowledge of entrepreneurship and self-employment
  3. Identify entrepreneurship opportunities
  4. Create entrepreneurial awareness
  5. Apply entrepreneurial motivation
  6. Develop business innovative strategies
  7. Develop Business plan

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Demonstrate understanding of an Entrepreneur | * principles of entrepreneurship * Types of entrepreneurs * Ways of becoming an Entrepreneur * Characteristics of Entrepreneurs * Factors affecting Entrepreneurship development | * Observation * Individual/group assignments * Written tests |
| 1. Demonstrate knowledge of entrepreneurship and self-employment | * Importance of self-employment * Requirements for entry into self-employment * Role of an Entrepreneur in business * Contributions of Entrepreneurs to National development * Entrepreneurship culture in Kenya * Born or made entrepreneurs | * Observation * Case studies * Individual/group assignments * Projects * Written tests * Oral questions * Third party report * Interviews |
| 1. Identify entrepreneurship opportunities | * Business ideas and opportunities * Sources of business ideas * Business life cycle * Legal aspects of business * Assessment of product demand * Business environment * Factors to consider when evaluating business environment * Technology in business | * Observation * Case studies * Individual/group assignments * Projects * Written tests * Oral questions * Third party report * Interviews |
| 1. Create entrepreneurial awareness | * Forms of businesses * Sources of business finance * Factors in selecting source of business finance * Governing policies on Small Scale Enterprises (SSEs) * Problems of starting and operating SSEs | * Observation * Case studies * Individual/group assignments * Projects * Written tests * Oral questions * Third party report * Interviews |
| 1. Apply entrepreneurial motivation | * Internal and external motivation * Motivational theories * Self-assessment * Entrepreneurial orientation * Effective communications in entrepreneurship * Principles of communication * Entrepreneurial motivation | * Observation * Case studies * Individual/group assignments * Projects * Written tests * Oral questions * Third party report * Interviews |
| 1. Develop business innovative strategies | * Innovation in business * Small business Strategic Plan * Creativity in business development * Linkages with other entrepreneurs * ICT in business growth and development | * Observation * Case studies * Individual/group assignments * Projects * Written tests * Oral questions * Third party report * Interviews |
| 1. Develop Business Plan | * Business description * Marketing plan * Organizational/Management * plan * Production/operation plan * Financial plan * Executive summary * Presentation of Business Plan | * Observation * Case studies * Individual/group assignments * Projects * Written tests * Oral questions * Third party report * Interviews |

**Suggested Methods of instruction:**

1. Direct instruction
2. Project
3. Case studies
4. Field trips
5. Discussions
6. Demonstration
7. Question and answer
8. Problem solving
9. Experiential
10. Internship
11. Team training
12. Guest speakers

**Recommended Resources**

1. Case studies
2. Business plan templates
3. Computers
4. Overhead projectors
5. Internet
6. Mobile phone
7. Video clips
8. Films
9. Newspapers and Handouts
10. Business Journals
11. Writing materials

# EMPLOYABILITY SKILLS

**UNIT CODE:** ENG/CU/TLE/BC/04/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate employability skills

**Duration of Unit:** 80 hours

**Unit Description**

This unit covers competencies required to demonstrate employability skills. It involves conducting self-management, demonstrating interpersonal communication, critical safe work habits, leading a workplace team, planning and organizing work, maintaining professional growth and development, demonstrating workplace learning, problem solving skills and managing ethical performance.

**Summary of Learning Outcomes**

1. Conduct self-management
2. Demonstrate interpersonal communication
3. Demonstrate critical safe work habits
4. Lead a workplace team
5. Plan and organize work
6. Maintain professional growth and development
7. Demonstrate workplace learning
8. Demonstrate problem solving skills
9. Manage ethical performance

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Conduct self-management | * Self-awareness * Formulating personal vision, mission and goals * Strategies for overcoming life challenges * Managing emotions * Emotional intelligence * Assertiveness versus aggressiveness * Expressing personal thoughts, feelings and beliefs * Developing and maintaining high self-esteem * Developing and maintaining positive self-image * Setting performance targets * Monitoring and evaluating performance * Articulating ideas and aspirations * Accountability and responsibility * Good work habits * Self-awareness * Values and beliefs * Self-development * Financial literacy * Healthy lifestyle practices * Adopting safety practices | * Observation * Written * Oral interview * Third party report |
| 1. Demonstrate interpersonal communication | * Meaning of interpersonal communication * Listening skills * Types of audience * Public speaking * Writing skills * Negotiation skills * Reading skills * Meaning of empathy * Understanding customers’ needs * Establishing communication networks * Assertiveness * Sharing information | * Observation * Written * Oral interview * Third party report |
| 1. Demonstrate critical safe work habits | * Stress and stress management * Time concept * Punctuality and time consciousness * Leisure * Integratingpersonal objectives into organizational objectives * Resources mobilization * Resources utilization * Setting work priorities * Developing healthy relationships * HIV and AIDS * Drug and substance abuse * Managing emerging issues | * Observation * Written * Oral interview * Third party report |
| 1. Lead a workplace team | * Leadership qualities * Power and authority * Team building * Determination of team roles and objectives * Team parameters and relationships * Individual responsibilities in a team * Forms of communication * Complementing team activities * Gender and gender mainstreaming * Human rights * Developing healthy relationships * Maintaining relationships * Conflicts and conflict resolution * Coaching and mentoring skills | * Observation * Oral interview * Written * Third party report |
| 1. Plan and organize work | * Functions of management * Planning * Organizing * Time management * Decision making concept * Task allocation * Developing work plans * Developing work goals/objectives and deliverables * Monitoring work activities * Evaluating work activities * Resource mobilization * Resource allocation * Resource utilization * Proactive planning * Risk evaluation * Problem solving * Collecting, analysing and organising information * Negotiation | * Observation * Oral interview * Written * Third party report |
| 1. Maintain professional growth and development | * Avenues for professional growth * Training and career opportunities * Assessing training needs * Mobilizing training resources * Licenses and certifications for professional growth and development * Pursuing personal and organizational goals * Managing work priorities and commitments * Recognizing career advancement | * Observation * Oral interview * Written * Third party report |
| 1. Demonstrate workplace learning | * Managing own learning * Mentoring * Coaching * Contributing to the learning community at the workplace * Cultural aspects of work * Networking * Variety of learning context * Application of learning * Safe use of technology * Taking initiative/proactivity * Flexibility * Identifying opportunities * Generating new ideas * Workplace innovation * Performance improvement * Managing emerging issues * Future trends and concerns in learning | * Observation * Oral interview * Written * Third party report |
| 1. Demonstrate problem solving skills | * Critical thinking process * Data analysis tools * Decision making * Creative thinking * Development of creative, innovative and practical solutions * Independence in identifying and solving problems * Solving problems in teams * Application of problem-solving strategies * Testing assumptions * Resolving customer concerns | * Observation * Oral interview * Written * Third party report |
| 1. Manage ethical performance | * Meaning of ethics * Ethical perspectives * Principles of ethics * Ethical standards * Organization code of ethics * Common ethical dilemmas * Organization culture * Corruption, bribery and conflict of interest * Privacy and data protection * Diversity, harassment and mutual respect * Financial responsibility/accountability * Etiquette * Personal and professional integrity * Commitment to jurisdictional laws * Emerging issues in ethics | * Observation * Oral interview * Written * Third party report |

**Suggested Methods of Delivery**

* Instructor lead facilitation of theory
* Demonstrations
* Simulation/Role play
* Group Discussion
* Presentations
* Projects
* Case studies
* Assignments

**Recommended Resources**

* Computers
* Stationery
* Charts
* Video clips
* Audio tapes
* Radio sets
* TV sets
* LCD projectors

# ENVIRONMENTAL LITERACY

**UNIT CODE**: ENG/CU/TLE/BC/05/6/A

**Relationship to Occupational Standards**:

This unit addresses the unit standard: Demonstrate environmental literacy

**Duration of Unit:** 40 hours

**Unit Description**

This unit describes the competencies required to control environmental hazard, control environmental pollution, comply with workplace sustainable resource use, evaluate current practices in relation to resource usage, identify environmental legislations/conventions for environmental concerns, implement specific environmental programs, monitor activities on environmental protection/programs, analyse resource use and develop resource conservation plans.

**Summary of Learning Outcomes**

1. Control environmental hazard
2. Control environmental Pollution
3. Demonstrate sustainable resource use
4. Evaluate current practices in relation to resource usage
5. Identify Environmental legislations/conventions for environmental concerns
6. Implement specific environmental programs
7. Monitor activities on Environmental protection/Programs
8. Analyse resource use
9. Develop resource conservation plans

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Control environmental hazard | * Purposes and content of Environmental Management and Coordination Act 1999 * Storage methods for environmentally hazardous materials * Disposal methods of hazardous wastes * Types and uses of PPE in line with environmental regulations * Occupational Safety and Health Standards (OSHS) | * Written questions * Oral questions * Observation of work procedures |
| 1. Control environmental Pollution control | * Types of pollution * Environmental pollution control measures * Types of solid wastes * Procedures for solid waste management * Different types of noise pollution * Methods for minimizing noise pollution | * Written questions * Oral questions * Observation of work procedures * Role play |
| 1. Demonstrate sustainable resource use | * Types of resources * Techniques in measuring current usage of resources * Calculating current usage of resources * Methods for minimizing wastage * Waste management procedures * Principles of 3Rs (Reduce, Reuse, Recycle) * Methods for economizing or reducing resource consumption | * Written questions * Oral questions * Observation of work procedures * Role play |
| 1. Evaluate current practices in relation to resource usage | * Collection of information on environmental and resource efficiency systems and procedures, * Measurement and recording of current resource usage * Analysis and recording of current purchasing strategies. * Analysis of current work processes to access information and data * Identification of areas for improvement | * Written questions * Oral questions * Observation of work procedures * Role play |
| 1. Identify Environmental legislations/conventions for environmental concerns | * Environmental issues/concerns * Environmental legislations /conventions and local ordinances * Industrial standard /environmental practices * International Environmental Protocols (Montreal, Kyoto) * Features of an environmental strategy | * Written questions * Oral questions * Observation of work procedures |
| 1. Implement specific environmental programs | * Community needs and expectations * Resource availability * 5s of good housekeeping * Identification of programs/Activities * Setting of individual roles /responsibilities * Resolving problems /constraints encountered * Consultation with stakeholders | * Written questions * Oral questions * Observation of work procedures * Role play |
| 1. Monitor activities on Environmental protection/Programs | * Periodic monitoring and Evaluation of activities * Gathering feedback from stakeholders * Analysing data gathered * Documentation of recommendations and submission * Setting of management support systems to sustain and enhance the program * Monitoring and reporting of environmental incidents to concerned /proper authorities | * Oral questions * Written tests * Practical test * Observation |
| 1. Analyse resource use | * Identification of resource consuming processes * Determination of quantity and nature of resource consumed * Analysis of resource flow through different parts of the process. * Classification of wastes for possible source of resources. | * Written tests * Oral questions * Practical test * Observation |
| 1. Develop resource Conservation plans | * Determination of efficiency of use/conversion of resources * Causes of low efficiency of use of resources * Plans for increasing the efficiency of resource use | * Written tests * Oral questions * Practical test * Observation |

**Suggested Delivery Methods**

* Instructor led facilitation of theory
* Practical demonstration of tasks by trainer
* Practice by trainees
* Observations and comments and corrections by trainers

**Recommended Resources**

* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Environmental Management and Coordination Act 1999
* Machine/equipment manufacturer’s specifications and instructions
* Personal Protective Equipment (PPE)
* ISO standards
* Company environmental management systems(EMS)
* Montreal Protocol
* Kyoto Protocol

# OCCUPATIONAL SAFETY AND HEALTH PRACTICES

**UNIT CODE:** ENG/CU/TLE/BC/06/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Demonstrate occupational safety and health practices

**Duration of Unit:** 40 hours

**Unit Description**

This unit describes the competencies required to comply with regulatory and organizational requirements for occupational safety and health.

**Summary of Learning Outcomes**

1. Identify workplace hazards and risk
2. Identify and implement appropriate control measures to hazards and risks
3. Implement OSHA programs, procedures and policies/guidelines

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Identify workplace hazards and risks | * Identification of hazards in the workplace and/or the indicators of their presence * Evaluation and/or work environment measurements of OSH hazards/risk existing in the workplace * Gathering of OSH issues and/or concerns | * Oral questions * Written tests * Observation of trainees identify hazards and risks |
| 1. Identify and implement appropriate control measure to hazards and risks | * Prevention and control measures e.g. use of PPE * Contingency measures | * Oral questions * Written tests * Practical tests * Observation of implementation of control measures |
| 1. Implement OSH   programs, procedures  and policies/guidelines | * Organization OSH program, procedures and policies/guidelines * Implementation of OSH procedures and policies/ guidelines * Training of team members and advice on OSH standards and procedures * Implementation of procedures for maintaining OSH-related records | * Oral questions * Written tests * Practical test * Observation |

**Suggested Delivery Methods**

* Instructor led facilitation of theory
* Demonstration by trainer
* Practical work by trainee
* Viewing of related videos

**Recommended Resources**

* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Machine/equipment manufacturer’s specifications and instructions
* Personal Protective Equipment (PPE) e.g.
* Mask
* Face mask/shield
* Safety boots
* Safety harness
* Arm/Hand guard, gloves
* Eye protection (goggles, shield)
* Hearing protection (ear muffs, ear plugs)
* Hair Net/cap/bonnet
* Hard hat
* Face protection (mask, shield)
* Apron/Gown/coverall/jump suit
* Anti-static suits
* High-visibility reflective vest

# COMMON UNITS OF LEARNING

# ENGINEERING MATHEMATICS

**UNIT CODE:** ENG/CU/TLE/CC/01/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply mathematical skills

**Duration of Unit:** 90 hours

**Unit Description**

This unit describes the competencies required by an Electrical Technician to apply a wide range of Engineering mathematics in their work. This includes applying algebraic functions, trigonometry and hyperbolic functions, complex numbers, coordinate geometry, binomial expansion, calculus, ordinary differential equations, laplace transforms, power series, Statistics, Fourier series, vector theory, matrix, numerical methods, probability, commercial calculations, estimations and measurements in solving problems

**Summary of Learning Outcomes**

1. Apply Algebra
2. Apply Trigonometry and hyperbolic functions
3. Apply complex numbers
4. Apply Coordinate Geometry
5. Carry out Binomial Expansion
6. Apply Calculus
7. Solve Ordinary differential equations
8. Apply Laplace transforms
9. Apply Power Series
10. Apply Statistics
11. Apply Fourier Series
12. Apply Vector theory
13. Apply Matrix
14. Apply Numerical methods
15. Apply concept of probability for work
16. Perform commercial calculations
17. Perform Estimations, Measurements and calculations of quantities

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Electrical Curriculum** | | |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| * 1. Apply Algebra | * Base and Index * Law of indices * Indicial equations * Laws of logarithm * Logarithmic equations * Conversion of bases * Use of calculator * Reduction of equations * Solution of equations reduced to quadratic form * Solutions of simultaneous linear equations in three unknowns * Solutions of problems involving AP and GP | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * 1. Apply Trigonometry and hyperbolic functions | * Half -angle formula * Factor formula * Trigonometric functions * Parametric equations * Relative and absolute measures * Measures calculation * Meaning of hyperbolic equations * Properties of hyperbolic functions * Evaluations of hyperbolic functions Hyperbolic identities * Osborne’s Rule * Ashx+bshx=C equation * One-to-one relationship in functions * Inverse functions for one-to-one relationship * Inverse functions for trigonometric functions * Graph of inverse functions * Inverse hyperbolic functions | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * 1. Apply complex numbers | * Meaning of complex numbers * Stating complex numbers in numbers in terms of conjugate argument and * Modulus * Representation of complex numbers on the Argand diagram * Arithmetic operation of complex numbers Application of De Moivre’s theorem * Application of complex numbers to engineering | * Assignments * Oral questioning * Supervised exercises * Written tests |
| * 1. Apply Coordinate Geometry | * Polar equations * Cartesian equation * Graphs of polar equations * Normal and tangents * Definition of a point * Locus of a point in relation to a circle * Loci of points for given mechanism | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * 1. Carry out Binomial Expansion | * Binomial theorem Power series using binomial theorem Roots of numbers using binomial theorem. * Estimation of errors of small changes using binomial theorem. | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * 1. Apply Calculus | * Meaning of derivatives of a function * Differentiation from fist principle * Tables of some common derivatives * Rules of differentiation * Rate of change and small change * Stationery points of functions of two variables * Meaning of integration * Indefinite and definite integral * Methods of integration application of integration. * Integrals of hyperbolic and inverse functions | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * 1. Solve Ordinary differential equations | * Types of first order differential equations * Formation of first order differential equation * Solution of first order differential equations * Application of first order differential equations * Formation of second order differential equations for various systems * Solution of second order differential equations * Application of second order differential equations | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * 1. Apply Laplace transforms | * Meaning of Laplace transforms deriving Laplace transforms from first principles * State properties of Laplace transform * Determination of inverse LT of simple transforms and partial fractions * Solution of differential equation by LT * Solution of simultaneous differential equation by given initial conditions | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * 1. Apply Power Series | * Meaning of the term power series * Taylor’s theorem * Deduction of Maclaurin’s theorem to obtain power series * Application of Taylor’s theorem and Maclaurin’s theorems in numerical work | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * 1. Apply Statistics | * Classification of data   Grouped data  Ungrouped data   * Data collection * Tabulation of data   Class intervals  Class boundaries  Frequency tables   * Diagrammatic and graphical presentation of data e.g.   Histograms  Frequency polygons  Bar charts  Pie charts  Cumulative frequency curves   * Measures of central tendency mean, mode and median * Measures of dispersion   Variance and standard deviation   * Definition of probability * Laws of probability * Expectation variance and S.D. * Types of distributions * Mean, variance and SD of probability distributions * Application of probability distributions | * Assignments * Oral questioning * Supervised exercises * Written tests * Simulation * Data modelling |
| * 1. Apply Fourier Series | * Determination of the Fourier series as a periodic function of the period 2π and extend to π * Determination of Fourier series of non-periodic functions over a given range * Determination of Fourier series for even and odd functions and the half-range series for a given function | * Assignments * Oral questioning * Supervised exercises * Written tests |
| * 1. Apply Vector theory | * Definition of dot and cross product of vectors * Solution of problems involving dot and cross production of cross * Definition of operators * Definition of vector field * Solutions of problems involving vector fields * Definition of Gradient, Divergence and curl * Solutions of involving Gradient, Divergence and curl * Application of vectors | * Assignments * Oral questioning * Supervised exercises * Written tests |
| * 1. Apply Matrix methods | * Matrix operation * Determinant of 3x3 matrix * Inverse of 3x3 matrix * Solutions of linear simultaneous equations in three unknowns * Application of matrices | * Assignments * Oral questioning * Supervised exercises * Written tests |
| * 1. Apply Numerical methods | * Meaning of interpolation and extrapolation * Application of interpolation * Application of interactive methods to solve equations * Application of interactive methods to areas and volumes | * Assignments * Oral questioning * Supervised exercises * Written tests |
| 1. Apply concepts of probability in work | * + Meaning of probability   + Types of probability events * Dependent * Independent * Mutually exclusive   + Laws of probability   + Counting techniques * Permutation * Combination * Tree diagrams * Venn diagrams | * Written tests * Assignments * Supervised exercises |
| 1. Perform commercial calculations | * + Product pricing   + Average sales determination   + Stock turnover   + Calculation of incomes   + Profit and loss calculations   + Salaries * Gross * Net   + Wages * Time rate * Flat rate * Overtime * Piece rate * Commission * Percentage * Bonus   + Conversion of one currency to another   + Exchange rates calculation * Devaluation * Revaluation | * Oral questioning * Written tests * Assignments * Supervised exercises |
| 1. Perform estimations, measurements and calculations of quantities | * Units of measurements and their symbols * Conversion of units of measurement * Calculation of length, width, height, perimeter, area and angles of figures * Measuring tools and equipment * Performing measurements and estimations of quantities | * Assignments * Oral questioning * Practical tests * Observation * Supervised exercises * Written tests |

**Suggested Delivery Methods**

* Group discussions
* Demonstration by trainer
* Exercises by trainee

**Recommended Resources**

* Scientific Calculators
* Rulers, pencils, erasers
* Charts with presentations of data
* Graph books
* Dice
* Computers with internet connection

# WORKSHOP TECHNOLOGY

**UNIT CODE:** ENG/CU/TLE/CC/02/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Perform Electrical workshop process

**Duration of Unit:** 60 hours

**Unit Description**

This unit specifies the competencies required to manage an electrical workshop. It includes applying workshop safety, use of workshop tools, instruments and equipment, preparation of workshop tools and instruments for an electrical installation practical, storage of electrical tools and materials after practical and troubleshooting and repair/ replacement of workshop tools and equipment

**Summary of Learning Outcomes**

1. Apply workshop safety
2. Use of workshop tools, Instruments and equipment
3. Prepare workshop tools and instruments for an Electrical installation practical
4. Prepare the workshop for an Electrical practical
5. Store Electrical tools and materials after practical
6. Troubleshoot and repair workshop tools and equipment

**Learning Outcomes, Content and Suggested Assessment Methods:**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Apply workshop safety | * Meaning of PPE * Standard operating procedure in PPE * Workshop rules * Electrical hazards e.g. * Electric shock. * Fire * Classes of fire * Causes of fire * Various methods of fire extinguishing * First Aid | * Oral questioning * Written tests |
| 1. Use of workshop tools, Instruments and equipments | * Meaning of workshop tools, instruments and equipments * Uses of workshop tools, Instruments and equipments * Classification of workshop tools and equipments * Care and Maintenance of workshop tools and Instruments | * Oral questioning * Practical tests * Written tests |
| 1. Prepare workshop tools and instruments for an Electrical installation practical | * Tools and instruments for an Electrical practical * Preparation of a list of tools and instruments for an Electrical practical. * Issuing and confirmation of tools and instruments before and after practical * Testing of practical tools and Instruments | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Prepare workshop for an Electrical practical | * Practical stations * Interpretation of a list of practical material | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Store Electrical tools and materials after practicals | * Classification of workshop tools and instruments. * Storage of workshop Tools and equipment * Waste disposal | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Troubleshoot and repair/replace workshop tools and equipment | * Meaning of troubleshooting * Common faults in Electrical equipments   Fault diagnosis procedure   * Repair/Replace of components in Electrical equipments | * Observation * Oral questioning * Practical tests * Written tests |

**Suggested Methods of Delivery**

* Demonstration by trainer
* Practice by the trainee
* Field trips
* On-job-training
* Discussions

**Recommended Resources**

|  |  |
| --- | --- |
| **Tools**   * Set of screw drivers * Pliers * Phase testers * Multimeter | **Materials and supplies**   * Stationery * Cables * Lubricants * Service parts |
| **Equipment**   * PPE –hand gloves, dust coat, dust masks * Multimeter * Clamp meter * Earth electrode resistance meter * Phase sequence meter | **Reference materials**   * IEE regulations * Organizational procedures manual |

# ELECTRICAL PRINCIPLES

**UNIT CODE:** ENG/CU/TLE/CC/03/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply Electrical principles

**Duration of Unit:** 80 hours

**Unit Description**

This unit describes the competencies required by a technician in order to apply a wide range of electrical principles in their work. Which includes; use of the concept of basic electrical quantities, use of the concepts of D.C and A.C circuits in electrical installation, use of basic electrical machine, use of power factor in electrical installation, use of earthing in electrical installations, apply lightning protection measures, apply electromagnetic field theory , apply electrodynamics, apply energy and momentum in electromagnetic field, apply transient in electrical circuit analysis, use two port network, demonstrate understanding of refrigeration and air conditioning

**Summary of Learning Outcomes**

1. Use the concept of basic Electrical quantities
2. Use the concepts of D.C and A.C circuits in electrical installation
3. Use of basic electrical machine
4. Use of power factor in electrical installation
5. Use of earthing in Electrical installations
6. Use of earthing in electrical installation
7. Apply lightning protection measures
8. Apply Electromagnetic field theory
9. Apply Electrodynamics
10. Apply Energy and momentum in Electromagnetic field
11. Apply Transient in Electrical circuit analysis
12. Use two port network
13. Demonstrate understanding of Refrigeration and Air conditioning

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| * + 1. Use the concept of basic Electrical quantities | * The meaning of SI unit * SI unit of various types of Electrical parameters * Ohm’s law * Calculations involving various Electrical parameters e.g Power, Current, Voltage, Resistance * Instruments used in measuring various types of Electrical parameters | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * + 1. Use the concepts of D.C and A.C circuits in electrical installation | * Meaning of terms * AC and DC, parallel and series circuits * AC and DC network theorems * AC to DC and DC to AC Conversion * Basic solar photovoltaic systems | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * + 1. Use of basic electrical machine | * Types of Electrical machines * DC machines, * AC Single and three phase motors, generators and Transformers * Motor starting methods e.g * DOL * Star-Delta * Auto-transformer * Resistance starter * Shaded pole * Split phase * Capacitor start * Capacitor Start and run * Face plate Starting * Application of AC and DC machines * Special machines and their Applications * Electric Drives | * Assignments * Oral questioning * Supervised exercises * Written tests * Practical tests |
| * + 1. Demonstrate understanding of three phase power supply | * Meaning of Terms * Three phase power supply connection * Star connection * Delta connection * Voltage, Current and power calculation * Measurements of power * Wattmeter methods * Interconnection of three phase power supply * Star- Delta and Delta- Star | * Assignments * Oral questioning * Practical tests * Observation * Written test |
| * + 1. Use of power factor in electrical installation | * Meaning of power factor * Meaning of terms * Power triangle * Power factor correction | * Assignments * Oral questioning * Practical tests * Observation * Supervised exercises * Written tests |
| * + 1. Use of earthing in Electrical installations | * + Terms in Earthing   + Earthing points in Electrical installation   + Methods of earthing   + Factors to consider in selecting an earthing method   + Testing an earthing system | * Assignments * Supervised exercises * Written tests * Practical test |
| * + 1. Apply lightening protection measures | * + Meaning of lightening   + Lightening strokes and their types   + Lightening protection components   + Testing a lightening system   + Application of lightening system   + Maintenance of lightening system | * Assignments * Oral questioning * Supervised exercises * Written tests |
| * + 1. Apply Electromagnetic field Theory | * + Meaning of Electromagnetic Field Theory   + Sources of Electromagnetic Fields   + Detectors of Electromagnetic radiation   + Application of Electromagnetic waves   + Electromagnetics Laws * Faraday’s Law * Lenz’s law * Fleming’s Laws * Properties and Effects of Electromagnetic waves * Wave Characteristics and Shielding * Skin Effect | * Assignments * Oral questioning * Supervised exercises * Written tests |
| * + 1. Apply Electrodynamics | * + Meaning of Electrostatics   + Identification of Electrostatic terms and their meaning   + Meaning of terms in magnetostatics   + Electrodynamics laws   Faraday’s law | * Assignments * Oral questioning * Supervised exercises * Written tests |
| * + 1. Apply Energy and Momentum in Electromagnetic field | * + Energy conservation theorem: * Poyntings’ Theorem * Momentum Energy Flow * Electromagnetic Energy flow | * Assignments * Oral questioning * Supervised exercises * Written tests |
| * + 1. Apply transients in Electrical Circuit Analysis | * + Meaning of Growth and decay in R-L & R-C circuits   + Calculations involving R-L& R-C circuits   + Application of Growth and decay in R-L & R-C Circuits | * Assignments * Oral questioning * Supervised exercises * Written tests |
| * + 1. Use Two Port networks | * + Meaning of passive networks * Types of Passive network   + Characteristic impedance in T & pie networks   + Design of T & pie networks   + Transmission lines   + ABCD Constants   + Network in cascade | * Assignments * Oral questioning * Supervised exercises * Written tests |
| * + 1. Demonstrate understanding of Refrigeration and Air conditioning | * Meaning of Refrigeration and Air Conditioning * Operation of Refrigeration and Air conditioning * Plant layout of Refrigeration and Air conditioning system | * Assignments * Oral questioning * Supervised exercises * Written tests |

**Suggested Delivery Methods**

* Group discussions
* Demonstration by trainer
* Exercises by trainee

**Recommended Resources**

* Scientific Calculators
* Relevant reference materials
* Stationeries
* Electrical workshop
* Relevant practical materials
* Dice
* Computers with internet connection

# TECHNICAL DRAWING

**UNIT CODE:** ENG/CU/TLE/CC/04/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Prepare and interpret technical drawings

**Duration of Unit:** 70hours

**Unit Description**

This unit covers the competencies required to prepare and interpret technical drawings. It involves competencies to select, use and maintain drawing equipment and materials. It also involves producing plain geometry drawings, solid geometry drawings, pictorial and orthographic drawings of components and application of Computer Aided Design (CAD) packages.

**Summary of Learning Outcomes**

1. Use and maintain drawing equipment and materials
2. Produce plane geometry drawings
3. Produce solid geometry drawings
4. Produce pictorial and orthographic drawings of components
5. Apply CAD packages

**Learning Outcomes, Content and Suggested Assessment Methods:**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Use and maintain drawing equipment and materials | * Identification and care of drawing equipment * Identification and care of drawing materials * Reference to manufacturer’s instructions and work place procedures on use and maintenance of drawing equipment and materials * Reference to relevant environmental legislations * Use of Personal Protective Equipment (PPEs) | * Observation * Oral questioning * Written tests |
| 1. Produce plane geometry drawings | * Types of lines in drawings * Construction of geometric forms e.g. squares, circles * Construction of different angles * Measurement of different angles * Bisection of different angles and lines * Standard drawing conventions | * Oral questioning * Practical tests * Observation |
| 1. Produce solid geometry drawings | * Interpretation of sketches and drawings of patterns e.g. cylinders, prisms and pyramids * Sectioning of solids e.g. prisms, cones * Development and interpenetrations of solids e.g. cylinder to cylinder and cylinder to triangular, prism | * Observation * Practical tests * Oral questioning |
| 1. Produce orthographic drawings | * Meaning of pictorial and orthographic drawings * Meaning of sectioning * Meaning of symbols and abbreviations * Drawing and interpretation of orthographic elevations * Dimensioning of orthographic elevations * Sectioning of views * Assembly drawing | * Observation * Practical tests * Oral questioning |
| 1. Produce pictorial drawings | * Meaning of pictorial drawings * Drawing objects in isometric view * Drawing objects in oblique view | * Observation * Oral questioning * Practical tests |
| 1. Produce electrical drawings | * Electrical symbols and abbreviations * Meaning of electrical drawings * Drawing of electrical diagrams e.g. block, schematic, circuit, line and wiring | * Observation * Oral questioning * Practical tests |
| 1. Apply CAD packages | * Identification of CAD packages e.g. AutoCAD, circuit maker * Use of CAD packages in drawing of: * Plane geometry * Solid * Orthographic * Pictorial * Electrical e.g. block, schematic, circuit, line and wiring | * Observation * Oral questioning * Practical tests |

**Suggested Methods of Delivery**

* Projects
* Demonstration by trainer
* Practice by the trainee
* Discussions

**Recommended Resources**

* Drawing room
* Drawing instruments e.g. T-squares, set squares, drawing sets
* Drawing tables
* Pencils, papers, erasers
* Masking tapes
* Computers installed with relevant CAD packages

# ELECTRONICS

**UNIT CODE:** ENG/CU/TLE/CR/05/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Demonstrate understanding of Electronics

**Duration of Unit:** 70 hours

**Unit Description**

This unit covers the competencies required to demonstrate understanding of electronics. Competencies includes; apply semiconductor theory, applying semiconductor diodes, demonstrating understanding of transistors, applying special semiconductor devices, performing rectification, applying amplifiers, demonstrating understanding of oscillators, applying wave shaping and pulse generation circuit and applying Opto-electronics

**Summary of Learning Outcomes**

* + 1. Apply semiconductor theory
    2. Apply semiconductor diodes
    3. Demonstrate understanding of transistors
    4. Apply Special semiconductor devices
    5. Perform rectification
    6. Apply amplifiers
    7. Demonstrate understanding of oscillators
    8. Apply wave shaping and pulse generation circuits
    9. Apply opto-electronics

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Demonstrate understanding of semiconductor theory | * Meaning of terms * Types of materials * Insulators * Conductors * Semiconductors * Semiconductor materials * Types of semiconductors materials * Intrinsic and Extrinsic | * Observation * Oral questioning * Written tests |
| 1. Demonstrate understanding of semiconductor diodes | * Meaning of terms * P-N juction * Semiconductor diodes * Foreward and reverse Characteristics * Types of semicondctor diodes * Application of semiconductors diodes | * Written tests * Oral questioning |
| 1. Demonstrate understanding of transistors | * Bipolar junction transistors * Operation of NPN and PNP * Field effect transistors * Operation N and P channels * Types of FETs * BJTs and FETs biasing * BJTs and FETs configuration * Characteristics of transistors * Gain of transistors * DC/AC load lines | * Observation * Oral questioning * Written tests |
| 1. Apply Special semiconductor devices | * Meaning of terms * Types of special semiconductor devices * UJT * SCR * LASCR * TRIAC * DIAC * SCS * Application of special semiconductor devices | * Observation * Oral questioning * Written tests |
| 1. Perform rectification | * Meaning of Terms * Classification of rectifiers * Types of rectifiers * Application of rectifiers * Types of converters * Application of converters | * Written tests * Oral questioning |
| 1. Apply amplifiers | * Meaning of terms * Types of amplifiers * RC coupled amplifiers * Small signal amplifier * Power amplifiers * Wideband amplifiers * Operational Amplifiers * DC Amplifiers * Differential amplifier * Op-amp Characteristics * Op-amp Circuits * Application of Amplifiers | * Written tests * Oral questioning |
| 1. Demonstrate understanding of oscillators | * Meaning of terms * Classification of oscillators * Sinusoidal * Non Sinusoidal * Oscillator requirements * Oscillator circuits * Damped and Undamped Oscillations | * Observation * Oral questioning * Written tests |
| 1. Apply wave shaping and pulse generation circuits | * Meaning of terms * Wave shaping * Pulse generation circuits * Application | * Observation * Oral questioning * Written tests |
| 1. Apply opto-electronics | * Theory of opto-electronics * Lasers and masers * Properties and drive requirement * LED * LCD * Plasma * Photo devices * Applications | * Observation * Oral questioning * Written tests |

**Suggested Methods of Delivery**

* Discussions
* Site visits
* On-job-training
* Charts and Audio-visual presentations

**Recommended Resources**

|  |  |
| --- | --- |
| **Equipment**   * Computers * Printers * Cameras * Phones | **Reference materials**   * Manufacturers’ catalogues * Working drawings * EMCA Act * OSHA * County by-laws |
| **Materials and supplies**   * Stationery |  |

# CORE UNITS OF LEARNING

# ELECTRICAL INSTALLATION

**UNIT CODE:** ENG/CU/TLE/CR/01/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Perform Electrical Installation

**Duration of Unit:** 70 hours

**Unit Description**

This unit specifies the competencies required for performing electrical installation. Competencies required includes; applying EHS Standards, conducting site survey, designing installation, performing system sizing, preparation of working drawings, planning for logistics, preparation of list of tools equipment and materials, preparation of installation work plan, establishment of installation team, preparation of work site, marking, piping and fixing accessories, performing installation, terminating installation testing and inspecting installation and finally preparation of tenders and service contracts.

**Summary of Learning Outcomes**

1. Apply EHS Standards
2. Conduct site survey
3. Design Electrical installation
4. Perform system sizing
5. Prepare working drawings
6. Plan for logistics
7. Prepare list of tools, equipment and materials
8. Prepare installation work plan
9. Establish installation team
10. Prepare work site
11. Perform marking, pipe and fixing of accessories
12. Perform Electrical Installation
13. Terminate Electrical Installation
14. Test and Inspect Electrical Installation
15. Prepare Tenders and Service contract

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| * + - 1. Apply EHS standards | * Relevant clauses in appropriate Acts e.g. * Occupational safety and health act (OSHA) * Work injury benefits act(WIBA) * Environment management and coordination Act (EMCA)   Relevant regulations:   * IEE regulations * KPLC by-laws * County by-laws * Causes of accidents and sources of danger e.g burns, cuts, electric shock, falling from heights, falling objects, noise, dust, chemicals * Meaning of term PPE * Purpose of PPE * Types of PPE * Safe and correct handling, use, maintenance and storage of different types of PPE * Classes of fires and fire fighting equipment * First aid procedures * Rescuing electric shock victim * Methods of resuscitation | * Written tests * Oral questioning * Observation |
| 1. Conduct site survey | * Type of installations * Domestic installations * Industrial installations * Commercial installations * Type of building e.g. * Permanent building * Semi-permanent buildings * Utilities available * Water * Electricity * Communication e.g. Phones * Installation conditions e.g. temperature, humidity, moisture * Taking measurements on site * Length e.g. conduits size * Total area * Temperature * Humidity * Preparation, analysis and documentation of survey report | * Written tests * Observation * Oral questioning |
| 1. Design Electrical Installation | * Meaning of terms * Types of wiring systems * Factors to consider in designing Electrical installation e.g. * Load size * Structure * Clients need * Types of supply * DC , Single phase and three phase | * Written tests * Observation * Oral questioning |
| 1. Perform system sizing | * Introduction to standards * IEE regulations. * Kenya bureau of standards (KEBS) * British standards * Kenya Power Company (KPC) by-laws * ERC regulations * County by-laws * National Construction Authority (NCA ) * Reference to relevant IEE regulation tables * Load Estimation e.g. * Factor of simultaneity (Ks) * Factor of utilization (Ku) * Determining cable : * Types * Ratings * sizes * Insulation type * Protective devices * Types * Ratings * Reference to relevant regulations | * Written tests * Observation * Oral questioning |
| 1. Prepare working drawing | * Working drawings * Meaning of working drawings * Identification and care of drawing instruments and equipment * Identification of drawing paper sizes * Drawing various types of lines * Drawing title block * Drawing standard electrical symbols * Conversion of scales * Interpretation of orthographic projections * Dimensioning of drawings * Drawing of electrical diagrams * Block * Circuits * Schematic * Wiring * Line * Reading and Interpretation of architectural drawings * Reading and Interpretation of electrical drawings * Use of Computer Aided Design (CAD) applications e.g. AutoCAD | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Plan for logistics | * Transport for: * Materials and their safety * Personnel * Storage of materials on site * Site security * Human resource * Skills required * Communication * Purpose * Modes | * Written tests * Oral questioning |
| 1. Prepare list of tools, equipment and materials | * Identification of tools and materials e.g. * Cutting tools * Measuring tools * Measuring equipment * Cables and conductors * Crimping tools * Conduits * Trunking * Consumables * Types, application, care, maintenance and storage of: * Tools e.g. * Cable strippers * Pliers * Screw drivers * Hammers * Chisels * Allen keys * Electrician knives * Crimping tools * Bending springs * Steel tapes * Draw wires * Hack saws * Drills * Equipment e.g. * Stock and die * Vice * Materials e.g. * Cables * Fittings * Accessories * Assemble tools, equipment and materials * Inventory management | * Oral questioning * Written tests * Observation * Practicals |
| 1. Prepare installation work plan | * Identification of scope of installation work * Identify installation team * Meaning of terms * Preparation of work schedules * Bar charts * Gantt charts * Critical path networks * Raise the necessary work permit and licences * Permit to work * Types of permit e.g. Gate pass, Name tags * Sources and application procedures in acquiring the permits * Classes of ERC licences   C2, C1, B, A2, A1 | * Oral questioning * Written tests * Observation * Practical |
| 1. Establish installation team | * Team building * Team members familiarization * Collaboration * Task distribution * Communication protocol | * Oral questioning * Written tests * Observation * Practical |
| 1. Prepare work site | * Identification of hazards and safety requirements for the site * Reference to relevant regulations e.g. * Occupational Safety and Health Act (OSHA) * County by-laws * Utilities * Access roads * Water * Electricity | * Oral questioning * Written tests * Observation * Practical |
| 1. Perform marking, piping and fixing of accessories | * Meaning of marking, piping, fixing and accessories in electrical installation * Importance of marking * Tools used in marking * Accessories used in Electrical installation e.g. * Lamp holders * Conduits * Ceiling roses * Patress | * Written tests * Observation * Oral questioning * Practical tests |
| 1. Perform electrical installation | * Meaning of terms * Single phase and three phase installation * Domestic Installation * Industrial Installation * Commercial Installation * Phase/load balancing * Cables and cable joints * Wiring systems and accessories * Meaning of terms * Types and applications e.g. * Conduits * Cable trays * Cable ducts * Trunkings * Preparation of wiring systems * Marking out, cutting, bending, threading, chiselling, trenching * Draw –in/Lay of cables routes * Cable Identification * Installation of final circuits * Lighting circuits * One way, two way, intermediate * Dimmer switches * Looping in methods at ceiling rose, joint boxes, switches * Power circuits * Radial circuits, ring circuits * Water heating circuits * Electric cooker circuits * Call and alarm circuits * Bell circuits * Intruder alarm circuits * Fire alarm circuits | * Written tests * Observation * Oral questioning * Practical test |
| 1. Terminate Electrical installation | * Meaning of Terms * Importance of termination * Cable labelling * Cable lugging * Tools used in cable termination e.g. * Crimping tool * Strip Knife | * Written tests * Oral questioning * Practical tests * Observation |
| 1. Test and inspect Electrical installation | * Meaning of terms * Types of tests e.g. * Earth continuity tests * Ring circuit test * Insulation tests * Short circuit tests * Open circuit test * Testing tools e.g. * Multimeter * Insulation tester * Ohmmeter * Importance of installation testing | * Oral questioning * Written tests * Observation * Practical |
| 1. Prepare tenders and service contracts | * Sources of law * Law of tort * Laws of contract and tendering * Types and forms of contract * Types of tenders * Tender estimation and costing * Statutory documents in contracts and tendering | * Oral questioning * Written tests * Observation * Practical |

**Suggested Methods of Delivery**

* Demonstration by trainer
* Practice by the trainee
* Field trips
* On-job-training
* Discussions

**Recommended Resources**

|  |  |
| --- | --- |
| **Tools**   * Measuring tools * Cutting tool * Drawing tools * Drilling tools * Fastening tools | **Materials and supplies**   * Stationery * Assorted Cables * Assorted protective devices * Pipes and trunkings * Cable lugs * Joints * Accessories |
| **Equipment**   * PPEs (Personal Protective Equipment) * Measuring equipment * Communication equipment | **Reference materials**   * Standards * County by-laws * Occupational Safety and Health Act (OSHA) * National Environmental Management Authority ( NEMA) regulations * National Construction Authority (NCA) regulations * IEE * tables |

# INSTALLATION OF BASE TRANSCEIVER STATION

**UNIT CODE:** ENG/CU/TLE/CR/02/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Install Base transceiver stations

**Duration of Unit:** 100 hours

**Unit Description**

This unit covers the competencies required to install Base transceiver station: Competencies include; conducting site survey, requesting for BTS installation (RFI), assembling tools, equipment and materials, preparing site installation layout, Installing (BTS), aligning installed Antenna, testing and commissioning installed Site and documenting installed Base Transceiver Station

**Summary of Learning Outcomes**

1. Conduct site survey
2. Request for BTS installation (RFI)
3. Assemble tools, equipment and materials
4. Prepare site installation layout
5. Install (BTS)
6. Align installed Antenna
7. Test and commission installed Site
8. Document installed Base Transceiver Station

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Conduct site survey | * Meaning of terms * Types of BTS (vendor, technology and coverage) installation process. * Survey tools and equipment * BTS installation conditions * Site measurements * BTS installation site orientation * Preparation, analysis and documentation of survey report. * Safety procedures. | * Observation * Oral questioning * Written tests * Practical test |
| 1. Request for BTS installation (RFI) | * Meaning of terms * The process of RFI in BTS installation * Elements of RFI * Factors to consider in preparation of RFI * Components of RFI report * Importance of RFI document * BTS installation acceptance period | * Observation * Oral questioning * Written tests * Practical test |
| 1. Assemble tools, equipment and materials | * Identification of BTS installation tools, equipment and materials * Classification and use of BTS installation tools, equipment and materials. * Tools and equipment status check and testing. * Assembling and storage of tools, equipment and materials | * Observation * Oral questioning * Written tests * Practical test |
| 1. Prepare site installation layout | * Meaning of terms * Determination of transmitters - receiver coverage. * Design of installation layout * Design approval * Factors to consider in preparation of installation layout * Preparation of installation layout. * Installation Layout assessment and approval. | * Observation * Oral questioning * Written tests * Practical test |
| 1. Install (BTS) | * Meaning of terms * Safety in installation of BTS * Procedure of installation of the BTS * Components of a BTS and installation procedure * Factors to consider in installation of the BTS * Weather proofing of a BTS. * EHS regulations. | * Observation * Oral questioning * Written tests * Practical test |
| 1. Align installed Antenna | * Meaning of terms * Safety in alignment of the installed antenna * Adjustment of the antenna azimuth and tilt. * Antenna protection system * Transmission frequency * Signal optimization | * Observation * Oral questioning * Written tests * Practical test |
| 1. Test and commission installed Site | * Meaning of terms * Types of tests * Factors to consider in testing of the BTS * BTS testing tools and instruments * BTS commissioning * Commissioning schedule * The process of BTS commissioning * Components of BTS commissioning | * Observation * Oral questioning * Written tests * Practical test |
| 1. Document installed Base Transceiver Station | * Preparation of BTS installation report * Report formats. * Report adoption, sharing and filing | * Observation * Oral questioning * Written tests |

**Suggested Methods of Delivery**

* Discussions
* Site visits
* On-job-training
* Schematic diagrams
* Charts and Audio-visual presentations

**Recommended Resources**

|  |  |
| --- | --- |
| **Equipment**   * Computers * Printers * Cameras * Phones * GPS * Laser meters * Telecommunication engineering toolbox. | **Reference materials**   * Manufacturers’ catalogues and manuals. * Working drawings * EMCA Act * OSHA * County by-laws |
| **Materials and supplies**   * Stationery |  |

# INSTALLATION OF SATELLITE SIGNAL REFLECTORS

**UNIT CODE:** ENG/CU/TLE/CR/03/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Install satellite signal Reflectors

**Duration of Unit:** 70 hours

**Unit Description**

This unit covers the competencies required to install satellite signal reflectors. Competencies include; conducting pre-installation live survey, assembling installation tools and equipment, identifying mounting location, aligning satellite signal reflector, connecting satellite receiver dish and box, testing and commissioning satellite signal installation and documenting satellite installation.

**Summary of Learning Outcomes**

1. Conduct pre-installation live survey
2. Assemble installation tools and equipment
3. Identify mounting location
4. Align satellite signal reflector
5. Connect satellite receiver dish and box
6. Test and commission satellite signal installation
7. Document satellite installation

**Learning Outcomes, Content and Suggested Assessment Methods:**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| * 1. Conduct pre-installation live survey | * Meaning of terms * Types of Satellite signal reflectors and installation process * Satellite installation conditions * Factors to consider when carrying out live survey for Satellite signal installation * Tools and equipment for live survey * Preparation, analysis and documentation of live-pre installation survey report | * Written tests * Oral questioning * Practical tests * Observation |
| * 1. Assemble installation tools and equipment | * Meaning of terms * Types of Satellite * Satellite installation tools, equipment and materials * Classification of Satellite installation tools, equipment and materials * Satellite installation instruments and the process of installation * Assembling and storage of tools, equipment and materials | * Observation * Oral questioning * Practical tests * Written tests |
| * 1. Identify mounting location | * Meaning of terms * Types and sizes of Satellite signal reflectors * Factors to consider during installation of Satellite reflectors * Near and far shading * Satellite signal strength and quality levels | * Observation * Oral questioning * Practical tests * Written tests |
| * 1. Align satellite signal reflector | * Meaning of Terms * Signal alignment * Satellite signal parameters * Noise * Quality * Frequency * strength * Instruments used in Satellite signal alignment * Signal alignment procedure | * Observation * Oral questioning * Practical tests * Written tests |
| * 1. Connect satellite receiver dish and box | * Meaning of terms * Safety in installation of Satellite signal reflectors * Factors to consider in installation of Satellite receiver dish and box * Power output * Strength * Impedance | * Observation * Oral questioning * Practical tests * Written tests |
| * 1. Test and commission satellite signal installation | * Meaning of terms * Types of Satellite tests in installation of satellite signal reflectors * Commissioning * Commissioning schedule and guidelines | * Observation * Oral questioning * Practical tests * Written tests |
| * 1. Document satellite installation | * Preparation of installation report * Report sharing and filing * Warranty and defects liability period | * Observation * Oral questioning * Practical tests * Written tests |

**Suggested Methods of Delivery**

* Projects
* Demonstration by trainer
* Practice by the trainee
* Field trips
* On-job training
* Discussions

**Recommended Resources**

|  |  |
| --- | --- |
| **Tools and equipment**   * Cable Strippers * Satellite finder meter * Camera * GPS tracker * Pliers * Screw drivers * Hammers * Chisels * Allen keys * Electrician knives * Crimping tools * Bending springs * Bending machine * Steel tapes * Draw wires * Hack saws * Drilling tools * Stock and die * Bench vice * Machine vice * PPE – hand gloves, dust coats, dust masks, helmets, ear muffs, industrial boots | **Materials and supplies**   * Stationery * Cables * Accessories * Conduits and fittings * Cable trays * Cable ducts * Trunkings * Computers * Drawing instruments * Screws |
| **Reference materials**   * IEE regulations * Occupational safety and health act (OSHA) * EHS standards * Work injury benefits act(WIBA) * Manufacturers’ catalogues * British standards * KEBS standards |  |

# SECURITY SYSTEM INSTALLATION

**UNIT CODE:** ENG/CU/TLE/CR/04/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Install Security System

**Duration of Unit:** 60 hours

**Unit Description**

This unit covers the competencies required in installing of security systems. Competencies includes; security system design, marking out of security systems zones, laying system cables, mounting accessories, terminate system cables and testing of the system.

**Summary of Learning Outcomes**

1. Design security system
2. Mark out security system zones or call points
3. Lay system cables
4. Mount accessories
5. Terminate system cables
6. Test and inspect security system

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Design Security system | * Meaning of Terms * Types of security systems e.g * CCTV * Alarms * Electric Fence * Components of security system * Smoke sensors * Vibration sensors * PIR sensors * Thermal sensors * Sirens and strobe * Security cameras * Transmitters * Receivers * Panic Button * Door Magnet * Data storage and backup * Factors to consider in design of security system * Wiring security system * Security system integration with other components | * Written tests * Oral questioning * Practical tests |
| 1. Mark out security system zones and call points | * Meaning of terms * Meaning of zones in security system * Marking, Piping and fixing tools e.g * Scribers * chalk * tape measure * Camera * Pliers * Importance of marking | * Oral questioning * Written tests * Practical tests |
| 1. Lay system cables | * Types of cables in security system * Factors to consider in security system cable laying * Segregation in cable laying * Importance segregations | * Observation * Written tests * Oral questioning * Practical tests |
| 1. Mount Accessories | * Meaning of terms * Accessories used in security system * Security system control panels * Insulation classes of enclosures e.g. * IP 44 ( Ingress protection) * IP 55 * IP 65 * IP 66 * IP 67 | * Observation * Oral questioning * Written tests * Practical tests |
| 1. Terminate System cables | * Meaning of termination * Meaning of Terms * Importance of termination * Cable lugging * Tools used in cable termination e.g. * Strip Knife * Crimping tool * Screw drivers * Spanners * Side cutter | * Observation * Oral questioning * Written tests * Practical tests |
| 1. Test and Inspect Security system | * Meaning Testing * Types of tests in security system e.g * Insulation test * Short circuit test * Continuity test * Firmness test * Arming and disarming tests | * Oral questioning * Written tests * Practical test |

**Suggested Methods of Delivery**

* Projects
* Demonstration by trainer
* Practice by the trainee
* Field trips
* On-job training
* Discussions

**Recommended Resources**

|  |  |
| --- | --- |
| **Equipment**   * Drawing instruments | **Materials and supplies**   * Computer * Stationery |
| * Smoke sensors * Vibration sensors * PIR sensors * Thermal sensors * Sirens and strobe * Security cameras * Transmitters * Receivers | **Reference materials**   * Manufacturers manuals * IEE regulations * County by-laws * CAK regulations |

# INSTALLATION OF INSIDE PLANT NETWORK

**UNIT CODE:** ENG/CU/TLE/CR/05/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Install inside Plant Network

**Duration of Unit:** 90 hours

**Unit Description**

This unit covers the competencies required to install inside plant network. Competencies include: Surveying network installation site, designing inside plant network, assembling installation tools, equipment and materials, installing network equipment and devices, configuring network devices, testing and commissioning installed network and documenting installed network

**Summary of Learning Outcomes**

1. Survey network installation site
2. Design inside plant network
3. Assemble installation tools, equipment and materials
4. Install network equipment and devices.
5. Configure network devices
6. Test and commission installed network
7. Document installed network

**Learning Outcomes, Content and Suggested Assessment Methods:**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Survey network installation site | * Meaning of terms * Types of inside plant network and installation process * Network installation conditions * Network designs. * Preparation, analysis and documentation of survey report * Network installation safety procedures. | * Written tests * Oral questioning * Practical tests * Observation |
| 1. Design inside plant network | * Meaning of terms * Network types * Designing inside plant network * Factors to consider in designing inside plant network * Network transmission platform * Network security. * Standards of network design | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Assemble installation tools, equipment and materials | * Meaning of terms * Tools, equipment and materials usage and storage. * Factors to consider when assembling network installation tools , equipment and materials | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Install network equipment and devices. | * Meaning of Terms * Factors to consider in installation of the inside plant network * Network components. * Network installation procedure * Network installation * IIE regulations in installation of inside plant network * Safety and waste disposal in installation of the network | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Configure network devices | * Meaning of terms * Network configuration * Configuration tools and equipment. * Standards of network configurations * Importance of manufacture’s manuals in network installation * Configuration of remote network access * Network segmentation * Network privileges * Network security and security threats | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Test and commission installed network | * Meaning of terms * Network testing * Types of tests * Testing tools and equipment * Factors to consider when carrying out network testing and commissioning * Network commissioning * Preparation of commissioning schedule * Commissioning procedure | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Document installed network | * Preparation of installation report * Report sharing and filing. * Warranties and defect liability period. | * Observation * Oral questioning * Practical tests * Written tests |

**Suggested Methods of Delivery**

* Projects
* Demonstration by trainer
* Practice by the trainee
* Field trips
* On-job training
* Discussions

**Recommended Resources**

|  |  |
| --- | --- |
| **Tools and equipment**   * Cable Strippers * Pliers * Screw drivers * Hammers * Chisels * Allen keys * Electrician knives * Crimping tools * Bending springs * Bending machine * Steel tapes * Draw wires * Hack saws * Drilling tools * Stock and die * Bench vice * Machine vice * PPE – hand gloves, dust coats, dust masks, helmets, ear muffs, industrial boots | **Materials and supplies**   * Stationery * Cables * Accessories * Conduits and fittings * Cable trays * Cable ducts * Trunkings * Computers * Drawing instruments * Screws |
| **Reference materials**   * IEE regulations * Occupational safety and health act (OSHA) * EHS standards. * Work injury benefits act(WIBA) * Manufacturers’ catalogues * British standards * KEBS standards |  |

# INSTALLATION OF IP PABX

**UNIT CODE:** ENG/CU/TLE/CR/06/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Install IP PABX

**Duration of Unit:** 85 hours

**Unit Description**

This unit covers the competencies required in installing IP PABX. Competencies includes; setting mini SIP Server, connecting local users to mini SIP Server, connecting mini SIP Server to VOIP providers' network, deploying network services, test and run installed IP PABX system and documenting installed PABX system.

**Summary of Learning Outcomes**

1. Setup mini SIP Server
2. Connect local users to mini SIP Server
3. Connect mini SIP Server to VOIP providers' network
4. Deploy network services
5. Test, commission and run installed IP PABX system
6. Document installed IP PABX system.

**Learning Outcomes, Content and Suggested Assessment Methods:**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| * + 1. IP PABX installation survey. | * Meaning of terms * Types of IP PABX and installation process * IP PABX installation conditions * Preparation, analysis and documentation of survey report * IP PABX installation safety procedures. | * Written tests * Oral questioning * Practical tests * Observation |
| * + 1. Setup mini SIP Server | * Meaning of terms * Types of SIP servers. * SIP server in relation to the installation of the IP PABX * Factors to consider when setting up the SIP server * Methods and the procedure of setting up the SIP server * Safety in installation of the IP PABX | * Written tests * Oral questioning * Practical tests * Observation |
| 1. Connect local users to mini SIP Server | * Meaning of terms * Connection of users to mini SIP server * Factors to consider when setting up SIP server | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Connect mini SIP Server to VOIP providers' network | * Meaning of terms * Methods equipment of connecting SIP server to VOIP providers network * Factor to consider when connecting SIP and VOIP | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Deploy network services | * Meaning of Terms * Methods of network deployment * Factors to consider when deploying network services | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Test, commission and run installed IP PABX system | * Meaning of terms * Testing * Types of tests * Testing tools and equipment * Factors to consider when testing IP PABX system * IP PABX system commissioning * Preparation of commissioning schedule. * Commissioning procedure | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Document installed, IP PABX system. | * Preparation of IP PBAX installation report * Report adoption, sharing and filing | * Observation * Oral questioning * Written tests |

**Suggested Methods of Delivery**

* Projects
* Demonstration by trainer
* Practice by the trainee
* Field trips
* On-job training
* Discussions

**Recommended Resources**

|  |  |
| --- | --- |
| **Tools and equipment**   * Cable Strippers * Pliers * Screw drivers * Hammers * Chisels * Allen keys * Electrician knives * Crimping tools * Bending springs * Bending machine * Steel tapes * Draw wires * Hack saws * Drilling tools * Stock and die * Bench vice * Machine vice * PPE – hand gloves, dust coats, dust masks, helmets, ear muffs, industrial boots | **Materials and supplies**   * Stationery * Cables * Accessories * Conduits and fittings * Cable trays * Cable ducts * Trunkings * Computers * Drawing instruments * Screws |
| **Reference materials**   * IEE regulations * Occupational safety and health act (OSHA) * EHS regulations. * Work injury benefits act(WIBA) * Manufacturers’ catalogues * British standards * KEBS standards |  |

# INSTALLATION OF FIBRE OPTIC CABLE

**UNIT CODE:** ENG/CU/TLE/CR/07/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Install Fibre Optic cable

**Duration of Unit:** 80 hours

**Unit Description**

This unit covers the competencies required in installing fibre optic cables. Competencies include: conducting site survey, acquiring authorisation documents, assembling tools, equipment and materials, building cable laying paths, laying fibre optic cable, splicing fibre optic cables, testing and commission fibre optic installation and documenting fibre optic installation report.

**Summary of Learning Outcomes**

1. Conduct site survey
2. Acquire authorisation documents
3. Assemble tools, equipment and materials
4. Build cable laying route
5. Lay fibre optic cable
6. Splice fibre optic cables
7. Test and commission fibre optic installation
8. Document fibre Optic câblé installation report

**Learning Outcomes, Content and Suggested Assessment Methods:**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Conduct site survey | * Meaning of terms * Safety in installation of fibre optic cable * Fibre Optic cable installation condition * Site measurements * Preparation, analysis and documentation of survey report * Fibre Optic cable installation site orientation | * Written tests * Oral questioning * Practical tests * Observation |
| 1. Acquire authorisation documents | * Meaning of terms * Relevant regulatory bodies in installation of fibre optic network * County by- laws * Way-leaves | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Assemble tools, equipment and materials | * Meaning of terms * Tools, equipment and materials in installation of fibre optic cable * Tools and material classification * Assembling of tools equipment and materials | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Build cable laying route | * Meaning of Terms * Construction of Fibre Optic cable laying routes * Safety in construction of cable laying routes * Factors to consider in construction of cable laying routes e.g. * Termination points * Security * Cost | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Lay fibre optic cable | * Meaning of terms * Ducts laying * Procedure and the process of laying Fibre Optic cable * Factors to consider in laying of Fibre Optic cable * Safety procedures | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Splice fibre optic cables | * Meaning of terms * Splicing of Fibre Optic cable * Factors to consider when splicing * Splicing tools, equipment and instruments * Loses in Fibre Optic Cable installation * Fibre Cable installation waste disposal | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Test and commission fibre optic installation | * Meaning of terms * Types of tests * Procedure of testing Fibre Optic cable * Testing tools and instruments * Fibre Optic network commissioning * Commissioning schedule | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Document fibre Optic cable installation report | * Preparation of Fibre Optic cable installation report * Report sharing and filing | * Observation * Oral questioning * Written tests |

**Suggested Methods of Delivery**

* Projects
* Demonstration by trainer
* Practice by the trainee
* Field trips
* On-job training
* Discussions

**Recommended Resources**

|  |  |
| --- | --- |
| **Tools and equipment**   * Cable Strippers * OTDR (Optical Time Domain Reflectometer) * Pliers * Fibre optic fusion splicing tool * Optical Power meter * Screw drivers * Hammers * Chisels * Allen keys * Electrician knives * Crimping tools * Bending springs * Bending machine * Steel tapes * Draw wires * Hack saws * Drilling tools * Stock and die * Bench vice * Machine vice * PPE – hand gloves, dust coats, dust masks, helmets, ear muffs, industrial boots | **Materials and supplies**   * Stationery * Cables * Accessories * Conduits and fittings * Cable trays * Cable ducts * Trunkings * Computers * Drawing instruments * Screws |
| **Reference materials**   * IEE regulations * Occupational safety and health act (OSHA) * EHS standards * Work injury benefits act(WIBA) * Manufacturers’ catalogues * British standards * KEBS standards |  |

# INSTALLATION OF COMMUNICATION EQUIPMENT

**UNIT CODE:** ENG/CU/TLE/CR/08/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: install communication equipment

**Duration of Unit:** 90 hours

**Unit Description**

This unit covers the competencies required in installing communication equipment. Competencies include; interpreting equipment design specifications, assembling telecommunication devices, connecting telecommunication devices, operating signal generator, operating signal electronic measuring instrument, inspecting communication cables, testing and commissioning installed equipment and documenting equipment installation report

**Summary of Learning Outcomes**

1. Interpret equipment design specifications
2. Assemble telecommunication devices
3. Install telecommunication equipment
4. Test and commission installed equipment
5. Document equipment installation report

**Learning Outcomes, Content and Suggested Assessment Methods:**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| * + - 1. Communication equipment installation survey. | * Meaning of terms * Types of communication equipment and installation process * Communication equipment installation conditions * Preparation, analysis and documentation of survey report * Communication equipment installation safety procedures. | * Written tests * Oral questioning * Practical tests * Observation |
| * + - 1. Interpret equipment design specifications | * Meaning of terms * Types of telecommunication equipment * Interpretation of manufacturers manuals of various telecommunication equipment * Factors to consider in identifying various equipment installation locations | * Written tests * Oral questioning * Practical tests * Observation |
| 1. Assemble telecommunication devices | * Meaning of terms * Tools, equipment and materials in installation of telecommunication equipment * Tools and material classification * Assembling of tools, equipment and materials | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Install telecommunication equipment | * Meaning of terms * Installation of various communication equipment * Equipment connection standards * Factors to consider in installation of various telecommunication equipment * Importance of manufacturers manuals in installation and operation of various telecommunication equipment * Safety in installation of various telecommunication equipment | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Test and commission installed equipment | * Meaning of Terms * Types of tests in various telecommunication equipment * Testing tools and instruments * Commissioning of various equipment * Commissioning schedule * Warranty and defects liability period | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Document communication equipment installation report | * Preparation of communication equipment installation report * Report sharing and filing | * Observation * Oral questioning * Practical tests * Written tests |

**Suggested Methods of Delivery**

* Projects
* Demonstration by trainer
* Practice by the trainee
* Field trips
* On-job training
* Discussions

**Recommended Resources**

|  |  |
| --- | --- |
| **Tools and equipment**   * Cable Strippers * Pliers * Screw drivers * Hammers * Chisels * Allen keys * Electrician knives * Crimping tools * Bending springs * Bending machine * Steel tapes * Draw wires * Hack saws * Drilling tools * Stock and die * Bench vice * Machine vice * PPE – hand gloves, dust coats, dust masks, helmets, ear muffs, industrial boots | **Materials and supplies**   * Stationery * Cables * Accessories * Conduits and fittings * Cable trays * Cable ducts * Trunkings * Computers * Drawing instruments * Screws |
| **Reference materials**   * IEE regulations * Occupational safety and health act (OSHA) * Work injury benefits act(WIBA) * Manufacturers’ catalogues * British standards * KEBS standards * EHS standards |  |

# INSTALLATION OF RADAR SYSTEM

**UNIT CODE:** ENG/CU/TLE/CR/09/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: install radar system

**Duration of Unit:** 110 hours

**Unit Description**

This unit covers the competencies required in installing radar systems. Competencies include; conducting site survey, assembling tools, equipment and materials, preparing radar installation location, mounting radar system, testing and commissioning installed radar system and documenting radar installation report.

**Summary of Learning Outcomes**

1. Conduct site survey
2. Assemble tools, equipment and materials
3. Prepare radar installation location
4. Mount radar system
5. Test and commission installed radar
6. Document radar installation report

**Learning Outcomes, Content and Suggested Assessment Methods:**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Conduct site survey | * Meaning of terms * Safety in installation of radar system * Types of radar systems * Factors to consider when installing radar systems * Radar system installation location * Site measurements * Preparation, analysis and documentation of survey report | * Written tests * Oral questioning * Practical tests * Observation |
| 1. Assemble tools, equipment and materials | * Meaning of terms * Tools, equipment and materials in installation of radar systems * Tools and material classification * Assembling of tools, equipment and materials | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Prepare radar installation location | * Meaning of terms * Preparation of radar system installation location * Factors to consider when preparing radar system installation location * Regulatory bodies and statutory document required in installation of radar system * Safety in installation of the radar system | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Mount radar system | * Meaning of terms * Components of radar system * Mounting of the radar system * Configuration of the radar system. * Operation of the radar system * Standards and the procedure of installing a radar system | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Test and commission installed radar | * Meaning of Terms * Types of tests in radar systems * Testing tools and instruments * Commissioning schedule and guidelines * Commissioning of radar systems. | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Document radar installation report | * Preparation of radar system installation report * Report adoption, sharing and filing | * Observation * Oral questioning * Practical tests * Written tests |

**Suggested Methods of Delivery**

* Projects
* Demonstration by trainer
* Practice by the trainee
* Field trips
* On-job training
* Discussions

**Recommended Resources**

|  |  |
| --- | --- |
| **Tools and equipment**   * Radar kit. * Cable Strippers * Pliers * Screw drivers * Hammers * Chisels * Allen keys * Electrician knives * Crimping tools * Bending springs * Bending machine * Steel tapes * Draw wires * Hack saws * Drilling tools * Stock and die * Bench vice * Machine vice * PPE – hand gloves, dust coats, dust masks, helmets, ear muffs, industrial boots | **Materials and supplies**   * Stationery * Cables * Accessories * Conduits and fittings * Cable trays * Cable ducts * Trunkings * Computers * Drawing instruments * Screws |
| **Reference materials**   * IEE regulations * Occupational safety and health act (OSHA) * EHS regulation. * Work injury benefits act(WIBA) * Manufacturers’ catalogues * British standards * KEBS standards |  |

# INSTALLATION OF BROADCASTING MONITOR

**UNIT CODE:** ENG/CU/TLE/CR/10/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: install broadcasting monitor

**Duration of Unit:** 85 hours

**Unit Description**

This unit covers the competencies required in installing broadcasting monitor. Competencies include; sourcing and connecting communication device and equipment, feeding signal in transmitter, aligning wave guides, operating frequency synthesizers, testing and commission installed broadcasting monitor and documenting monitor installation report.

**Summary of Learning Outcomes**

1. Source and connect communication device and equipment
2. Feed signal in transmitter
3. Align wave guides
4. Operate frequency synthesizers
5. Test and commission installed broadcasting monitor
6. Document monitor installation report

**Learning Outcomes, Content and Suggested Assessment Methods:**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Source and connect communication device and equipment | * Meaning of terms * Sourcing communication devices * Installation and connection of communication devices * Process and procedure of installing communication devices. * Safety procedures. | * Written tests * Oral questioning * Practical tests * Observation |
| 1. Feed signal in transmitter | * Meaning of terms * Signal transmitters * Operation * The process of feeding signals in transmitters * Transmitter signal output | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Align wave guides | * Meaning of terms * Wave guide alignment * Effects of broadcasting monitors size in wave guide alignment * Safety in installation of broadcasting monitors | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Operate frequency synthesizers | * Meaning of terms * Operation and tuning of frequency synthesizers * Factors to consider when operating frequency synthesizers * Safety in operation of frequency synthesisers | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Test and commission installed broadcasting monitor | * Meaning of Terms * Types of tests in broadcasting monitors * Testing procedure * Testing tools and instruments * System connectivity * Commissioning of broadcasting monitors * Commissioning schedule | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Document monitor installation report | * Preparation of broadcasting monitor installation report * Report sharing and filing | * Observation * Oral questioning * Practical tests * Written tests |

**Suggested Methods of Delivery**

* Projects
* Demonstration by trainer
* Practice by the trainee
* Field trips
* On-job training
* Discussions

**Recommended Resources**

|  |  |
| --- | --- |
| **Tools and equipment**   * Oscilloscope * Monitor screens * Cable Strippers * Pliers * Screw drivers * Hammers * Chisels * Allen keys * Electrician knives * Crimping tools * Bending springs * Bending machine * Steel tapes * Draw wires * Hack saws * Drilling tools * Stock and die * Bench vice * Machine vice * PPE – hand gloves, dust coats, dust masks, helmets, ear muffs, industrial boots | **Materials and supplies**   * Stationery * Cables * Accessories * Conduits and fittings * Cable trays * Cable ducts * Trunkings * Computers * Drawing instruments * Screws |
| **Reference materials**   * IEE regulations * Occupational safety and health act (OSHA) * EHS regulations * Work injury benefits act(WIBA) * Manufacturers’ catalogues * British standards * KEBS standards |  |

# INSTALLATION OF TELEPHONE NETWORK

**UNIT CODE:** ENG/CU/TLE/CR/11/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: install telephone network

**Duration of Unit:** 70 hours

**Unit Description**

This unit covers the competencies required in installing telephone network. Competencies include: surveying installation premises, identifying network installation area, mounting KSU, plugging of the circuit cards into the KSU, interconnecting telephone line with the KSU.

**Summary of Learning Outcomes**

1. Survey installation premises
2. Identify network installation area
3. Mount KSU( Norstar Key Service Unit)
4. Plug circuit cards into KSU
5. Interconnect telephone lines to KSU
6. Interconnect KSU with phone units.
7. Code KSU unit.
8. Test telephone network
9. Document installed telephone network

**Learning Outcomes, Content and Suggested Assessment Methods:**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Survey installation premises | * Meaning of terms * Safety in installation of telephone network * Survey tools and material requirement * Pre-installation site visit * Preparation, analysis and documentation of survey report | * Written tests * Oral questioning * Practical tests * Observation |
| 1. Identify network installation area | * Meaning of terms * KSU installation location * Handset/phones installation location * Communication cable laying | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Mount KSU( Norstar Key Service Unit) | * Meaning of terms * Mounting of the KSU * Tools and instruments used in mounting of the KSU * Physical strength and tolerance in mounting of the KSU * Safety in mounting of the KSU | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Plug circuit cards into KSU | * Meaning of terms * Circuit cards * Procedure of installing circuit cards into the KSU | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Interconnect telephone lines to KSU | * Meaning of terms * Wiring of the KSU * Cable laying routes * Cable laying and termination * Termination points | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Interconnect KSU with phone units. | * Meaning of terms * Wiring of KSU with the phone units * Powering of the handsets * Handsets firmware upgrading * Safety in wiring of the phone unit | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Code KSU unit. | * Meaning of terms * Programming of the KSU unit * Checking and debugging of KSU unit programs * Upgrading of KSU unit firmware | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Test telephone network | * Meaning of Terms * Types of tests in telephone network * Inbound and outbound calls * Extension to extension. * Toll restrictions. * Call forwarding and transfer. * Testing procedure * Testing tools and instruments | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Document installed telephone network | * Preparation of network installation report * Report sharing and filing | * Observation * Oral questioning * Practical tests * Written tests |

**Suggested Methods of Delivery**

* Projects
* Demonstration by trainer
* Practice by the trainee
* Field trips
* On-job training
* Discussions

**Recommended Resources**

|  |  |
| --- | --- |
| **Tools and equipment**   * Ethernet cable tester. * Cable Strippers * Pliers * Screw drivers * Hammers * Chisels * Allen keys * Electrician knives * Crimping tools * Bending springs * Bending machine * Steel tapes * Draw wires * Hack saws * Drilling tools * Stock and die * Bench vice * Machine vice * PPE – hand gloves, dust coats, dust masks, helmets, ear muffs, industrial boots | **Materials and supplies**   * Stationery * Cables * RJ connectors * Cable clips * Accessories * Conduits and fittings * Cable trays * Cable ducts * Trunkings * Computers * Drawing instruments * Screws |
| **Reference materials**   * IEE regulations * EHS regulations. * Occupational safety and health act (OSHA) * Work injury benefits act(WIBA) * Manufacturers’ catalogues * British standards * KEBS standards |  |

# TV AND RADIO SIGNALS BROADCAST

**UNIT CODE:** ENG/CU/TLE/CR/12/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: broadcast TV and Radio signals

**Duration of Unit:** 90 hours

**Unit Description**

This unit covers the competencies required in broadcasting TV and Radio signals. Competencies include; maintaining programming logs, controlling audio equipment, operating monitor and converse, regulating sound fidelity, recording audio or video signals, monitoring signal strength, aligning transmitting and receiving antennas and maintaining broadcasting equipment.

**Summary of Learning Outcomes**

1. Maintain programming logs
2. Control audio equipment
3. Operate monitors and converse
4. Regulate sound fidelity
5. Record audio or video signals
6. Monitor signal strength
7. Align transmitting and receiving antennas
8. Maintain broadcasting equipment

**Learning Outcomes, Content and Suggested Assessment Methods:**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Maintain programming logs | * Meaning of terms * Programming logs * Converse. * Maintenance of programming logs * Logs back up * Provision of programming logs * ICT Policy | * Written tests * Oral questioning * Practical tests * Observation |
| 1. Control audio equipment | * Meaning of terms * Type of broadcast * Selection of the control equipment * Operation of audio equipment | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Operate monitors and converse | * Meaning of terms e.g. * Operation of monitors and converse * Quality of video and audio signals * CAK policies, Rules and Regulation in operation of monitors and converse | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Regulate sound fidelity | * Meaning of terms e.g. * Sound Fidelity * Regulating sound fidelity * Factors affecting sound fidelity. * Sound quality * Tools and Instruments used in regulating sound fidelity | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Record audio or video signals | * Meaning of terms * Adjustment of audio and video recording equipment. * Video and audio library management. * IEE, AVS (audio video coding standards) | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Monitor signal strength | * Meaning of terms e.g. * Signal strength * Signal quality * Signal monitoring * Standards in signal monitoring | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Align transmitting and receiving antennas | * Meaning of terms * Factors to consider when choosing transmitters and receivers e.g * Area of coverage * Terrain * Broadcasting frequency band. * Types of antenna and propagation features. * Antenna alignment * Signal Transmission and Reception. | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Maintain broadcasting equipment | * Meaning of Terms * Types of maintenance e.g. * Routine * Periodic * Breakdown * Maintenance activities * Maintenance procedures of audio and visual equipment * Spares and tools inventory eg. * Updating of spares and tools inventory * Reorder levels. | * Observation * Oral questioning * Practical tests * Written tests |

**Suggested Methods of Delivery**

* Projects
* Demonstration by trainer
* Practice by the trainee
* Field trips
* On-job training
* Discussions

**Recommended Resources**

|  |  |
| --- | --- |
| **Tools and equipment**   * Oscilloscope * Signal generator * Cable Strippers * Pliers * Screw drivers * Hammers * Chisels * Allen keys * Electrician knives * Crimping tools * Bending springs * Bending machine * Steel tapes * Draw wires * Hack saws * Drilling tools * Stock and die * PPE – hand gloves, dust coats, dust masks, helmets, ear muffs, industrial boots | **Materials and supplies**   * Stationery * Cables * Light fittings * Accessories * Conduits and fittings * Cable trays * Cable ducts * Trunkings * Computers * Drawing instruments * Screws * Recorder cleaner.s |
| **Reference materials**   * IEE regulations * CAK regulations * EHS regulations * Occupational safety and health act (OSHA) * Work injury benefits act(WIBA) * Manufacturers’ catalogues * British standards * KEBS standards |  |

# TCP-IP AND NETWORKING

**UNIT CODE:** ENG/CU/TLE/CR/13/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: perform TCP-IP and Networking

**Duration of Unit:** 80 hours

**Unit Description**

This unit covers the competencies required in installing SME and Home IP networks. Competencies includes; setting IP network, connecting local users to network, connecting users to network resources, deploying network services, testing and run installed IP network system and documenting installed IP network.

**Summary of Learning Outcomes**

1. Conduct site survey
2. Design TCP-IP network
3. Perform TCP-IP network Planning.
4. Setup private and public IP network
5. Test, commission and run installed IP network
6. Document installed IP network

**Learning Outcomes, Content and Suggested Assessment Methods:**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Conduct site survey | * Meaning of terms e.g. * Mode of network access * Equipment and services deployment * Factors to consider when conducting site survey for TCP-IP and networking * Network security * Preparation, analysis and documentation of network survey report | * Written tests * Oral questioning * Practical tests * Observation |
| 1. Design TCP-IP network | * Meaning of terms * Types of network e.g * Ethernet(wired) * Wireless(wifi,wimax) * Fiber. * Designing of TCP-IP network * Factors to consider when designing TCP-IP network * Network design standards * Regulatory bodies in network design, approval and installation | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Perform TCP-IP network Planning. | * Meaning of terms * Network set up planning * Network set up tools, equipment and materials * Network installation resources * Logistics and checklist preparation * Statutory documents required network installation * Network installation team and specialization | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Setup private and public IP network | * Meaning of terms e.g. * Configuration tools, materials * Installation and configuration of network * Configuration of IP addressing scheme, subnet masking and routing protocol. * Network segmentation(VLANs) * Factors to consider in setting up private and public IP network * Deployment of network services * Network security. * IEEE regulations | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Test, commission and run installed IP network | * Meaning of terms * Testing tools and instruments * Testing procedure | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Document installed IP network | * Preparation of network installation report * Report sharing and filing | * Observation * Oral questioning * Practical tests * Written tests |

**Suggested Methods of Delivery**

* Projects
* Demonstration by trainer
* Practice by the trainee
* Field trips
* On-job training
* Discussions

**Recommended Resources**

|  |  |
| --- | --- |
| **Tools and equipment**   * Cable Strippers. * Ethernet cable tester * Pliers * Screw drivers * Hammers * Chisels * Allen keys * Electrician knives * RJ Crimping tools * Bending springs * Bending machine * Steel tapes * Draw wires * Hack saws * Drilling tools * Stock and die * Bench vice * Machine vice * PPE – hand gloves, dust coats, dust masks, helmets, ear muffs, industrial boots | **Materials and supplies**   * Stationery * Cables * Accessories * Conduits and fittings * Cable trays * Cable ducts * Trunkings * Computers * Drawing instruments * Screws * RJ connector * Optical and electrical patch cords. |
| **Reference materials**   * IEE regulations * CAK * Occupational safety and health act (OSHA) * Work injury benefits act(WIBA) * Manufacturers’ catalogues * British standards * KEBS standards |  |

# MAINTENANCE OF TELECOMMUNICATION EQUIPMENT AND SYSTEMS

**UNIT CODE:** ENG/CU/TLE/CR/14/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Maintain Electrical Equipment and systems

**Duration of Unit:** 70 hours

**Unit Description**

This unit covers the competencies required to carry out maintenance in electrical equipment and systems. The maintenance includes scheduling maintenance, inspecting and testing electrical equipment and systems, test the system and document maintenance records. .

**Summary of Learning Outcomes**

1. Prepare maintenance schedule
2. Inspect and test electrical equipment and systems
3. Prepare list a list of maintenance tools
4. Perform maintenance activities
5. Conduct system tests
6. Document maintenance records

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| * 1. Prepare maintenance schedule | * Maintenance * Meaning of terms * Maintenance checklist * Maintenance work plan and tools * Identification of maintenance personnel * Types of maintenance and procedures * Periodic service * Preventive * Breakdown * Corrective * Scheduling maintenance based on service manuals * Safety precautions to be observed during maintenance | * Written tests * Oral questioning |
| * 1. Prepare a list of maintenance tools | * Identification and documentation of maintenance tools * Specifications of identified maintenance tools * Handling and storage of maintenance tools * Classification of maintenance tools e.g. * Cutting tools * Fastening tools * Measuring tools. | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Inspect, test and troubleshoot telecommunication equipment and system. | * Meaning of terms * Types of faults * Identification of faulty components * System isolation points e.g. * MDF(Main distribution frame) * PSU(Power supply unit) * RF connection. * Factors to consider in identification of maintenance activities * Types of tests * Inspection procedures * Recording of inspection findings | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Perform maintenance activities | * Identification of faulty components on a telecommunication equipment or system * Repair/Replacement of faulty components * Maintenance activities e.g. * Disassembling * Cleaning * Repairing * Tightening * Oiling * Assembling * System backup * Maintenance checklist * Disposal of waste materials e.g. * Old batteries * Oils * Lugs and screws * Tapes * Cable sheaths * Off cuts | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Conduct system test | * Types of tests * Identification of test points and parameters * Identification of test tools * Safe test procedures | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Document maintenance records | * Maintenance report writing * Procedure of writing maintenance report * Recording archiving * Components of maintenance report * Test results documentation | * Observation * Oral questioning * Practical tests * Written tests |

**Suggested Methods of Delivery**

* Demonstration by trainer
* Practice by the trainee
* Field trips
* On-job-training
* Discussions

**Recommended Resources**

|  |  |
| --- | --- |
| **Tools**   * VSWR spectrum analyzer * Set of screw drivers * Set of spanners and wrenches * Power tools * Cutting tools * Pliers * Lifting and tensioning tools * Tool box * Phase tester * blower | **Materials and supplies**   * Stationery * Cables * Lubricants * Service parts * RF cables and connectors * Weather proofing material. * Cleaning agents. |
| **Equipment**   * PPE –hand gloves, dust coat, dust masks * Multimeter. | **Reference materials**   * Service manuals * IEE regulations * Organization procedures manual |

# TELECOMMUNICATION PROJECT MANAGEMENT

**UNIT CODE:** ENG/CU/TLE/CR/15/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Manage Electrical project

**Duration of Unit:** 60 hours

**Unit Description**

This unit covers the competencies required to manage an electrical project. Competencies includes; preparation of work plans and policies, managing project team, managing material, tools and equipment, managing project budget, supervising and assessing project implementation, preparing project reports and commissioning

**Summary of Learning Outcomes**

1. Prepare work plans and policies
2. Manage Project team
3. Manage materials, tools and equipment
4. Manage project budget
5. Supervise and assess project implementation
6. Prepare project reports
7. Project commissioning

**Learning Outcomes, Content and Suggested Assessment Methods:**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Prepare work plans and policies | * Meaning of terms * Project planning * Elements of project planning * Factors to consider in project planning * Project Objectives e.g. SMART * Project cycle * Initiation * Planning * PERT * CPM * Execution * Closure * Project policies | * Written tests * Oral questioning * Observation * Practical test |
| 1. Manage Project team | * Meaning of terms * Project personnel * Work break down structure * SWOT analysis * Project organization structure * Training of the project team * EHS Standards in project | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Manage materials, tools and equipment | * Identification of tool, materials and equipment in a project * Classification, maintenance and storage of tools, materials and equipment * Tools, materials and equipment inventory system * Calibration of tools and equipment. | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Manage project budget | * Meaning of terms * Project Budgetary process * Elements of the budget * Project cost management (PCM) | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Supervise and assess project implementation | * Meaning of terms * Project cycle * Project monitoring and evaluation * Project quality control * EHS standards | * Written tests * Oral questioning |
| 1. Prepare project reports | * Project report * Preparation of the project report e.g. * Progress reports * Completion report * Elements of report * Documentation of the project report and operation manual | * Written tests * Oral questioning * Observation |
| 1. Test and commission the project. | * Completion certificate * Importance * Components * Handover documents * User manuals * End user training. * Warranties and defect liability period. | * Written tests * Oral questioning * Observation |

**Suggested Methods of Delivery**

* Projects
* Demonstration by trainer
* Practice by the trainee
* Field trips
* On-job training
* Discussions

**Recommended Resources**

|  |  |
| --- | --- |
| **Tools and equipment**   * Cutting * Measuring tools * Drilling tools * Fastening tools * Computers * Phones * Camera * Transport * GPS | **Materials and supplies**   * Stationeries * Computers * Application software |
| **Reference materials**   * IEE regulations * Occupational safety and health act (OSHA) * Work injury benefits act(WIBA) * CAK * County bylaws * Way leaves. * Manufacturers’ catalogues * British standards * KEBS standards |  |

# INSTALLATION OF TELECOMMUNICATION TRANSMISSION EQUIPMENT

**UNIT CODE:** ENG/CU/TLE/CR/16/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: to install telecommunication transmission equipment.

**Duration of Unit:** 100 hours

**Unit Description**

This unit covers the competency required to install telecommunication transmission equipment. Competencies include: conducting site survey, planning installation of telecommunications transmission equipment, assembling installation tools and equipment, installing telecommunications transmission hardware and cabling, installing telecommunications transmission accessories, configuring and testing of installed system, cleaning-up installation site and commissioning and documentation of installed telecommunication transmission equipment

**Summary of Learning Outcomes**

1. Conduct site survey
2. Plan for installation of telecommunications transmission equipment
3. Assemble tools, equipment and materials
4. Install telecommunications transmission hardware and cabling
5. Install telecommunications transmission accessories
6. Configure and test the system
7. Clean-up installation site
8. Commission and complete system documentation

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Conduct site survey | * Meaning of terms * Types of Transmission equipment (Microwave and Fibre) * Survey tools and equipment * Transmission installation conditions * Microwave line of site (LOS) * Transmission site installation requirements * Preparation, analysis and documentation of survey report. * Safety procedures. | * Observation * Oral questioning * Written tests * Practical test |
| 1. Plan for installation of telecommunications transmission equipment | * Meaning of terms * Installation plan * Work preparation * Site accessibility and hazards * Verification of installation location * Tools and equipment * Network outage | * Observation * Oral questioning * Written tests * Practical test |
| 1. Assemble tools, equipment and materials | * Meaning of terms * Transmission equipment installation tools, equipment and materials * Classification and use of installation tools, equipment and materials. * Assembling and storage of tools, equipment and materials | * Observation * Oral questioning * Written tests * Practical test |
| 1. Install telecommunications transmission hardware and cabling | * Meaning of terms * Safety in installation of transmission equipment * Procedure of installation of the transmission equipment * Components of a transmission equipment and installation procedure * Factors to consider in installation of the transmission equipment * Types of transmission modules and cables * Weather proofing of transmission equipment. * EHS regulations. | * Observation * Oral questioning * Written tests * Practical test |
| 1. Install telecommunication transmission accessories | * Meaning of terms * Safety in installation of equipment * Determination of alarms and functions * Operation and maintenance system | * Observation * Oral questioning * Written tests * Practical test |
| 1. Configure and test the system | * Meaning of terms * Types of software applications in transmission equipment installation * Software installation * Types of tests * Factors to consider in testing of the transmission equipment * Transmission equipment testing tools and instruments * Types of measurements (Frequency, Optical) * Signal optimization | * Observation * Oral questioning * Written tests * Practical test |
| 1. Clean-up installation site | * Meaning of terms * Waste disposal | * Observation * Oral questioning * Written tests * Practical test |
| 1. Commission and complete system documentation | * Meaning of terms * Transmission equipment commissioning * Commissioning schedule * The process of transmission equipment commissioning * Components of transmission equipment commissioning * Preparation of transmission equipment installation report * Report formats. * Report adoption, sharing and filing | * Observation * Oral questioning * Written tests * Practical test |

**Suggested Methods of Delivery**

* Discussions
* Site visits
* On-job-training
* Schematic diagrams, Charts and Audio-visual presentations

**Recommended Resources**

|  |  |
| --- | --- |
| **Equipment**   * Computers * Printers * Cameras * Binoculars * Spectrum analyser * Phones * GPS * Laser meters * Telecommunication engineering toolbox. | **Reference materials**   * Manufacturers’ catalogues and manuals. * Working drawings * EMCA Act * OSHA * County by-laws |
| **Materials and supplies**   * Stationery |  |

# INSTALLATION WI-FI NETWORK

**UNIT CODE:** ENG/CU/TLE/CR/17/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Install WIFI Network

**Duration of Unit:** 90 hours

**Unit Description**

This unit covers the competencies required in installing WI-FI network. Competencies include: surveying WI-FI network installation site, designing WI-FI network, assembling installation tools, equipment and materials, installing WI-FI network equipment and devices, configuring WI-FI network devices, testing and commissioning installed WI-FI network and documenting installed WIFI network

**Summary of Learning Outcomes**

1. Survey WIFI network installation site
2. Design WIFI network
3. Assemble installation tools, equipment and materials
4. Install WIFI network equipment and devices.
5. Configure WIFI network devices
6. Test and commission installed WIFI network
7. Document installed WIFI network

**Learning Outcomes, Content and Suggested Assessment Methods:**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Survey WIFI network installation site | * Meaning of terms * Types of network and installation process * WI-FI Network installation conditions * WI-FI Frequency channels * Installation coverage * Preparation, analysis and documentation of survey report * Network installation safety procedures. | * Written tests * Oral questioning * Practical tests * Observation |
| 1. Design WIFI network | * Meaning of terms * Network types * Designing WI-FI network * Factors to consider in designing WI-FI network * Network transmission platform * Network security. * Standards of network design | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Assemble installation tools, equipment and materials | * Meaning of terms * Tools, equipment and materials * Usage and storage. * Factors to consider when assembling network installation tools , equipment and materials | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Install WI-FI network equipment and devices. | * Meaning of Terms * Factors to consider in installation of the WI-FI network * WI-FI Network components. * Network installation procedure * Network installation * IEE regulations in installation of WI-FI network * Safety and waste disposal in network installation | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Configure WIFI network devices | * Meaning of terms * Network configuration * Configuration tools and equipment. * Standards of network configurations * Importance of manufacture’s manuals in network installation * Stability and connectivity test * Network segmentation * Network privileges * Network security and security threats | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Test and commission installed WIFI network | * Meaning of terms * WI-FI Network testing * Types of tests * Testing tools and equipment * Factors to consider when carrying out WI-FI network testing and commissioning * Network commissioning * Preparation of commissioning schedule * Commissioning procedure | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Document installed WIFI network | * Preparation of installation report * Report sharing and filing. * Warranties and defect liability period. | * Observation * Oral questioning * Practical tests * Written tests |

**Suggested Methods of Delivery**

* Projects
* Demonstration by trainer
* Practice by the trainee
* Field trips
* On-job training
* Discussions

**Recommended Resources**

|  |  |
| --- | --- |
| **Tools and equipment**   * Cable Strippers * Pliers * Screw drivers * Hammers * Chisels * Allen keys * Electrician knives * Crimping tools * Bending springs * Bending machine * Steel tapes * Draw wires * Hack saws * Drilling tools * Stock and die * Bench vice * Machine vice * PPE – hand gloves, dust coats, dust masks, helmets, ear muffs, industrial boots | **Materials and supplies**   * Stationery * Cables * Accessories * Conduits and fittings * Cable trays * Cable ducts * Trunkings * Computers * Drawing instruments * Screws |
| **Reference materials**   * IEE regulations * Occupational safety and health act (OSHA) * EHS standards. * Work injury benefits act(WIBA) * Manufacturers’ catalogues * British standards * KEBS standards |  |