REPUBLIC OF KENYA

TECHNICAL, INDUSTRIAL, VOCATIONAL AND
ENTREPRENEURSHIP TRAINING

CRAFT CERTIFICATE IN ELECTRICAL AND ELECTRONIC TECHNOLOGY TELECOMMUNICATION OPTION

SYLLABUS AND REGULATIONS

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FEBRUARY 2009

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Contents

Foreword

The Technical Industrial Vocational and Entrepreneurship Training (TIVET) programmes have been revised to cater for new technology, issues and trends that have emerged since early '90s when the syllabi were developed under the Technical Education Project (TEP) programme. The review process has necessitated removal of outdated/irrelevant content. In addition, the content has been revised and new areas included to help the graduates of the programme acquire knowledge, practical skills, attitudes and competence relating to occupations in various sectors of economic and social life.

The syllabus is designed and organised to guide the trainer in the depth of teaching, with a clear outline of the general objectives, specific objectives, teaching/learning activities and suggested methods of evaluating the trainee's achievement.
The curriculum is modular and competency based allowing for trainees' exit to the world of work and easy re-entry to the course.

I am grateful to the staff of Kenya Institute of Education, subject and course panel members at the Kenya Institute of Education, the KIE academic board, the staff of the MoHEST and all those who participated in the development and the production of this syllabus.

Director Technical Education
Ministry of Higher Education Science and Technology

1.0 General Introduction

1.1 National Goals f Education

The overall education policy goal of the Government of Kenya is to achieve the Millennium Development Goals (MDGs) and Education for all (EFA) goals by 2015 in tandem with the national and international commitments. The vision of the Ministry of Education, is "to have a globally competitive education, training and research for Kenya's sustainable development" while the mission is "to provide, promote, coordinate the provision of quality education, training and research for the empowerment of individuals to become responsible and competent citizens who value education as a lifelong process" as envisaged by Kenya Vision 2030. The national goals of education are given below:

i) Foster nationalism, patriotism and promote national unity

Kenya's people belong to different ethnic groups, races and religions, but these differences need not divide them. They must be able to live and interact as Kenyans. It is a paramount duty of education to help the youth acquire this sense of nationhood, by removing conflicts and by promoting positive attitudes of mutual respect, which enable them to live together in harmony, and foster patriotism in order to make a positive contribution to the life of the Nation.

ii) Promote the social economic, technological and industrial needs for national development

Education should prepare the youth of the country to play an effective and productive role in the life of the nation.

- **Social Needs**

Education in Kenya must prepare children for the changes in attitudes and relationships, which are necessary for the smooth process of a rapidly developing modern economy. There is bound to be a silent social revolution following in the wake of rapid modernization. Education should assist our youth to adapt to this change.

- **Economic Needs**

Education in Kenya should produce citizens with skills, knowledge, expertise and personal qualities that are required to support a growing economy. Kenya is building up a

modern and independent economy, which is in need of adequate domestic manpower.

- **Technological and Industrial Needs**

Education in Kenya should provide the learners with the necessary skills and attitudes for Industrial development. Kenya recognizes the rapid industrial and technological changes taking place, especially in the developed world. We can only be part of this development if our education system deliberately focused on knowledge, skills and attitudes that will prepare the youth for these changing global trends.

iii) Promote individual development and self-fulfilment

Education should provide opportunities for the fullest development of individual talents and personality. It should help children to develop their potential, interests and abilities. A vital aspect of individual development is character building.

iv) Promote sound moral and religious values

Education should provide for the development of knowledge, skills and attitudes that will enhance acquisition of sound moral values and help children to grow up into self-disciplined, self-reliant and integrated citizens.

v) Promote social equality and responsibility

Education should promote social equality and foster a sense of social responsibility within an education system, which provides equal education opportunities for all. It should give all children varied and challenging opportunities for collective activities and corporate social service, irrespective of gender, ability or geographical environment.

vi) Promote respect for and development of Kenya's rich and varied cultures

Education should instil in the youth of Kenya an understanding of past and present cultures and their valid place in contemporary society. The children should be able to blend the best of traditional values with the changed requirements that, must follow rapid development in order to build a stable and modern society.

vii) Promote international consciousness and foster positive attitudes towards other nations

Kenya is part of the international community. It is part of the complicated and interdependent network of peoples and nations. Education should, therefore, lead the youth of the country to accept membership in this international community with all the obligations and responsibilities, rights and benefits that this membership entails.

viii) Promote positive attitudes towards good health and environmental protection

Education should inculcate in the youth the value for good health in order to avoid indulging in activities that will lead to physical or mental ill health. It should foster positive attitudes towards environmental development and conservation. It should lead the youth to appreciate the need for a healthy environment.

1.2 National Aims of Technical Training Programmes

The aims of the technical training at both post primary and post secondary levels should be to:

a) provide training opportunities for the increasing number of school leavers to enable them to be self-supporting
b) develop practical skills and attitudes which will lead to income generating activities in the urban and rural areas through self-employment
c) provide practical education and training skills which are responsive and relevant to
d) Kenya's agricultural, industrial, commercial and economic needs
e) provide the technical knowledge and vocational skills necessary to enhance the pace of this nation's development
f) encourage self-employment while at the same time producing skilled artisans, technicians and technologists for both formal and informal sectors at the ratio of one technologist to five technicians to 30 craftsmen/artisans (1:5:30).

1.3 Objectives of the Craft Training Programmes

The general objectives of the craft training programmes are to:

a) develop skills which will be responsive and relevant to the country's human resources required at the middle level

b) prepare the trainees so that they can enter the world of work with confidence for either salaried employment or self-employment

c) impart adequate skills which will enable the trainee to operate either as a craftsman or perform middle level supervisory functions.

2.0 Introduction to the Course

The Craft Certificate in Electrical and Electronic Technology Telecomunication option course is designed for Kenya Certificate of Education graduates (or equivalent qualifications), to provide trainees with skills, knowledge and attitudes for the installation, operation, service and maintenance of electrical installation systems and basic electronic equipment.

The course is in modular form and it is designed to enable trainees acquire adequate competence for formal and informal employment and also to prepare them for further training.

The course is in two modules. Each module prepares the trainee to perform specific tasks whose total value combined will impart the desired competence to the trainees, to produce the required graduate at the end of the course.

The course puts emphasis on practical work and competence acquisition. Thus the trainee is required to spend 20 % of the total hours on theory and 80 % on practical lessons. The trainers are encouraged to continuously carry out research to establish the emerging trends and issues in each area and integrate them in the teaching, taking into considerations the interests of persons with disability in each lesson, as prescribed in the Persons with Disability Act of 2003.

2.2 General Objectives of the Course

By the end of the course the trainee should be able to:

a) demonstrate positive attitudes towards self employment
b) communicate effectively in matters of electrical and telecommunication engineering at his/her level
c) observe environmental, health and safety regulations and requirements and codes of practice and standards when working
d) install service and maintain data communication equipment
e) use scientific and mathematical concepts to solve electrical problems
f) appreciate the role of management in the telecommunication field

2.3 General Regulations

2.3.1 Approval of the Training Institutions

Institutions offering this course should be recognized and approved by the Ministry responsible for Training.

2.3.2 Duration of the Course

The course is designed to have 1980 hours. 1650 hours shall be spent in the training institutions while 330 hours shall be spent on Industrial Attachment. The course duration shall be as outlined below.

	Institution Time (Hours)	**Industrial Attachment Time (Hours)**	**Total Time (Hours)**
Module I	825		825
Module II	825	330	1155
Total	**1650**	**330**	**1980**

2.3.3 Entry Requirements

Trainees entering this course should have any of the following as the minimum entry requirement:

a) Passed Artisan course in Electrical Installation

OR

b) Passed Kenya Certificate of Secondary Education (KCSE) with an Mean grade of D (D plain)

OR

c) Passed National Vocational Certificate of Education and Training (NVCET) in Electrical and Electronic Technology Option II

OR

d) Equivalent qualifications as shall be determined by Kenya National Examinations Council (KNEC)

2.3.4 Examinable Units

All the units in each module of the course are examinable

Module I		**Suggested mode of assessment**
3.1.0	Entrepreneurship Education	Theory
5.1.0	Course Foundations and General Information	Theory
6.1.0	Technical Drawing	Practice
7.1.0	Mathematics I	Theory
8.1.0	Applied Science	Theory and practice
9.1.0	Workshop Technology	Theory and practice
10.1.0	Electrical Principles I	Theory and practice
11.1.0	Electronics	Theory and practice
12.1.0	Electrical Installations Technology I	Theory and practice
13.1.0	Solar Installation Systems	Theory and practice
Module II		
14.2.0	Life Skills	
15.2.0	Electrical Principles II	Theory and practice
16.2.0	Communication Skills	Theory and practice
17.2.0	Workshop Organisation and Management	Theory
18.2.0	Mathematics II	Theory
19.2.0	Micro Electronics	Theory and practice
20.2.0	Radio Systems	Theory and practice
21.2.0	Television Fundamentals	Theory and practice
22.2.0	Data Communication	Theory and practice
23.2.0	Instruments and Electronic Fault Diagnosis	Theory and practice
24.2.0	Business Plan	Practice
25.2.0	Trade Project	Practice

Candidates do not have to take all the papers of a module at the same sitting

2.4 Attendance and Course Work Requirements

The candidates are expected to register for training at an institution approved for the course for the theoretical and practical studies.

2.4.1 Coursework Marks

Continuous assessment marks for the course work must be kept by the institution and details must be submitted to the Kenya National Examinations Council (KNEC) in respect of each candidate entered for the examinations at least two weeks before the external examination is taken.

2.4.2 Coursework Assessment

Continuous assessment will be given a weighting of 30% and the external examinations by KNEC will be given a weighting of 70% in the determination of the final grade.

2.4.3 Compulsory Industrial Attachment/Internship for Trainees

Before the end of the course, every trainee shall undergo industrial an attachment/internship of 330 hours. Industrial attachment shall be an integral part of training and its assessment shall form part of the final grade and certification.

The training institutions in collaboration with the organization where the trainee is attached shall supervise the trainee during the Industrial Attachment. The examining body shall provide the modalities of industrial attachment assessment.

2.4.4 Project Work

A project in this context means a research carried out by an individual trainee. It may be practical, mathematical, evaluative, and descriptive or research based project. The project must have well defined Objectives so that the trainee has something definite to aim at, without inhibiting his/her initiative. The aim of the project is to give trainees an opportunity to carry out an independent work. The management and the assessment methods of project work shall be determined by KNEC and the training institutions.

2.5 Examinations and Award of Certificates

2.5.1 Assessment

The assessment of all the modules shall be competency based.

2.5.2 Internal Examinations

The training institutions will conduct course work and/or project work assessments based on the competences acquired during the training. The institutions will offer internal examinations at the end of each module and keep these records for use at the end of the course to determine the final grade. The course work or project work and/or assessments shall also be used during the re-entry to the course or for the award of credit transfer.

2.5.3 External Examinations

The Kenya National Examinations Council (KNEC) will offer external examinations

to trainees in all modules covered during the training.

2.5.4 Eligibility for Candidates Entering Into External Examinations

Candidates for external examinations must at the time of entry to the examinations, have successfully completed the required competencies in each course modules.

2.5.5 Coursework/continuous Assessment

Coursework/continuous Assessment will be prepared and marked by the institutions.

The institutions will issue statement of results while the examining body will award a certificate after completion of the relevant modules.

2.5.6 Examination Results

In order to qualify for the award of Craft certificate in Electrical and electronic Technology, Telecommunication Option, the candidate must pass all the modules of the course. Results of the examination as a whole will be issued in five classes and for the individual papers will be in eight grades. Each candidate will receive all records of performance, giving the result in terms of class and grade.

The relationship between classes and grades is:

- Pass with distinction Grade 1 and 2
- Pass with credit Grade 3 and 4
- Pass Grade 5 and 6
- Referred Grade 7
- Fail Grade 8

Candidates, who fail any paper (module unit) in a particular module, will be REFERRED in the failed paper and will be allowed to re-sit three **(3)** times and pass within a period of five **(5)** years after the date of the first sitting. Thereafter the candidate will be discontinued from further re-sitting the paper(s).

2.5.7 Award of Certificate

The KNEC will issue the candidates with result slips for Modules passed and a final certificate in Craft certificate in Electrical and electronic Technology, Telecommunication Option

2.5.8 General Examination Regulation

In the event of any inconsistency arising between the regulations as set out in this syllabus and the General Regulations published by the examining body, the General Regulations of the KNEC shall prevail.

2.6 Course Coding and Time Allocation

Craft certificate in Electrical and electronic Technology, Telecommunication Option

	Module Units	Time **Hrs**
Module I		
3.1.0	Entrepreneurship Education	66
4.1.0	Information and Communication Technology (ICT)	100
5.1.0	Course Foundations and General Information	36
6.1.0	Technical Drawing	55
7.10	Mathematics	44
8.1.0	Applied Science	68
9.1.0	Workshop Technology	55
10.1.0	Electrical Principles I	88
11.1.0	Electronics	99
12.1.0	Electrical Installation I	170
13.1.0	Solar Installation Systems	44
Total Time for Module I		**825**
ModuleII		
14.2.0	Life Skills	66
15.2.0	Electrical Principles II	99
16.2.0	Communication Skills	66
17.2.0	Workshop Organisation And Management	44
18.2.0	Mathematics II	66
19.2.0	Micro Electronics	55
20.2.0	Radio Systems	104
21.2.0	Television Fundamentals	77
22.2.0	Data Communication	66
23.2.0	Instruments and Electronic Fault Diagnosis	88
24.2.0	Business Plan	44
25.2.0	Trade Project	50
Total Time for Module II		**825**
Industrial Attachment		**330**
Total Time for the Course		**1980**

CRAFT CERTIFICATE IN ELECTRICAL AND ELECTRONIC TECHNOLOGY

TELECOMMUNICATION OPTION

MODULE I

MODULE I

INTRODUCTION

The module is designed for all trainees who meet the minimum entry requirements for Craft Certificate in Electrical and Electronic Technology, Power Option course.

It is intended to impart knowledge skills and attitudes that will meet the needs of electrical and electronic technology industry for operators who will install, repair and service electrical, electronic equipment and electrical installations.
Upon completion of this module, trainees will have acquired knowledge and skills in power distribution, utilization, basic electronics and solar installations. The trainees will also acquire generic skills which will make them adaptable to the dynamic world of work.

The units in this module are:

1. Entrepreneurship Education
2. Information and Communication Technology (ICT)
3. Course Foundations and General Information
4. Technical Drawing
5. Mathematics I
6. Applied Science
7. Workshop Technology
8. Electrical Principles I
9. Electronics
10. Solar Installation Systems

GENERAL OBJECTIVES

By the end of the module, the trainee should:

a) communicate effectively in matters of electrical and electronic technology
b) apply information communication technology in the electrical and electronic trade
c) apply entrepreneurial skills in the trade
d) apply quality control while providing services in the trade
e) appreciate environment health and safety
f) appreciate the career and its progression path.

KEY COMPETENCE

By the end of the module the trainee should be able to demonstrate the following Competence:

The trainee should have the ability to:

i) install repair and service extra low and low voltage installations
ii) cost electrical and electronic tasks
iii) repair and service basic electronic devices
iv) install repair and service solar installation systems
v) work with various computer packages.

3.1.0 ENTREPRENEURSHIP EDUCATION

3.1.01 Introduction

This module unit is intended to equip the trainee with necessary knowledge; skills and attitudes that will enable him/her start, operate and manage a personal or group business enterprise effectively. It is also intended to instill in a trainee the drive necessary to venture into profit making activities.

3.1.02 General Objectives

By the end of the module unit, the trainee should be able to:

a) demonstrate positive attitude towards self employment
b) understand concepts and elements of entrepreneurship
c) development
d) demonstrate entrepreneurial behaviour in starting, operating and
e) managing a business
f) prepare a viable business plan.

3.1.0 Entrepreneurship

Module Unit Summary and Time Allocation

Code	Sub Module Unit	• Content	Time Hrs
3.1.1	Entrepreneurship	• Definition of terms • Contribution of entrepreneurship towards national development • Self employment versus salaried employment	6
3.1.2	Evolution of Entrepreneurship	• History of entrepreneurship in Kenya • Economic, political and social factors affecting entrepreneurial development • Entrepreneurial cultural practices in Kenya, South Africa and India	6
3.1.3	Entreprenuerial Culture	• The entrepreneurial culture • Cultural factors that promote entrepreneurial development	4

		• Cultural factors inhibiting entrepreneurial development • Ways of managing factors that inhibit development of entrepreneurial culture	
3.1.4	The Entrepreneur	• Myths associated with entrepreneurship • Types of entrepreneurs • Characteristics/traits of an entrepreneur • Roles of an entrepreneur in an enterprise	4
3.1.5	Entrepreneurial Opportunities	• Business ideas • Business idea generation • Sources of business ideas • Identification and evaluation of business opportunities • Matching Competence with business opportunities	6
3.1.6	Starting a Small Business	• for ms of business ownership • Factors to be considered when starting a small enterprise • Procedure of starting a small enterprise • Business life cycle • Challenges faced when starting a small enterprise • Resources for a business	6
3.1.7	Enterprise Management	• Definition of terms • Managing enterprise resources • Managing the business finances • Business records • Business support services • Marketing activities in a small enterprise	8
3.1.8	Enterprise Social Responsibilities	• Meaning of enterprise social responsibility • Importance of enterprise social responsibility • Social concerns of an enterprise	4

3.1.9	Business Plan	• The Business Plan • Components of a Business Plan	10
3.1.10	Information and Communication Technology in Entrepreneurship	• Benefits of ICT to a small enterprise • Use of computer applications software in a small business	10
3.1.11	Emerging Trends In Entrepreneurship	• Emerging trends in enterprise management • Challenges posed by emerging trends in entrepreneurship • Management of challenges posed by emerging trends and issues in entrepreneurship	2
Total time			**66**

3.1.1 INTRODUCTION TO ENTREPRENEURSHIP

Theory

3.1.1T0 *Specific Objectives*
By the end of the sub module unit, the trainees should be able to:
a) define various terms used in entrepreneurship
b) explain the contribution of entrepreneurship towards national development
c) explain the differences between self and salaried employment.

Competence
The trainee should have the ability to contribute to national development through self employment.

Content
3.1.1T1 Definition of terms
3.1.1T2 Contribution of entrepreneurship towards national development
3.1.1T3 Self employment versus salaried employment

Practice

3.1.1P0 *Specific Objective*
By the end of the sub module unit, the trainees should be able to identify the role played by employer and employee.

Content

3.1.1P1 Visit a business enterprise in the locality and interview employers/employees and identify their roles.

3.1.2 EVOLUTION OF ENTREPRENEURSHIP

Theory

3.1.2T0 Specific Objectives
By the end of the sub module unit, the trainee should be able to:
a) describe the history of entrepreneurship in Kenya
b) explain economic, political and social factors affecting
c) entrepreneurial development
d) explain various entrepreneurial cultural practices in Kenya, South
e) Africa and India.

Competence
The trainee should have the ability to handle social factors that hinder entrepreneurial development.

Content

3.1.2T1 History of entrepreneurship in Kenya
3.1.2T2 Economic, political and social factors affecting entrepreneurial development
3.1.2T3 Entrepreneurial cultural practices in Kenya, South Africa and India

Practice

3.1.2P0 *Specific Objective*
By the end of the sub module unit, the trainee should be able to identify cultural practices in Kenya, South Africa and India

Content

3.1.2P1 Case study on economic, political and social factors affecting entrepreneurial development in Kenya, South Africa and India

3.1.3 ENTREPRENEURIAL CULTURE

Theory

3.1.3T0 Specific Objectives

By the end of the sub module unit, the trainee should be able to:

a) explain the concept of entrepreneurial culture
b) outline cultural habits that enhance entrepreneurial development
c) outline cultural factors inhibiting entrepreneurial development
d) explain ways of managing factors that inhibit development of
e) entrepreneurial culture in Kenya.

Competence
The trainee should have the ability to deal with cultural biases that hinder entrepreneurial development

Content

3.1.3T1 Entrepreneurial culture
3.1.3T2 Cultural habits that promote entrepreneurial development
3.1.3T3 Cultural factors inhibiting entrepreneurial development
3.1.3T4 Ways of managing factors that inhibit development of entrepreneurial culture in Kenya

Practice

3.1.3P0 *Specific Objective*

By the end of the sub module unit, the trainee should be able to identify the cultural habits which promote or inhibit entrepreneurial development.

Content

3.1.3P1 Visit a successful entrepreneur in the locality and collect information on cultural habits that inhibit or promote entrepreneurial development

3.1.4 THE ENTREPRENUER

Theory

3.1.4T0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to:

a) explain the myths associated with entrepreneurship
b) describe types of entrepreneurs
c) state the characteristics/traits of an entrepreneur
d) explain the roles of an entrepreneur in an enterprise.

Competence

The trainee should have the ability to identify entrepreneurial potential in self.

Content

3.1.4T1 Myths associated with entrepreneurship
3.1.4T2 Types of entrepreneurs
3.1.4T3 Characteristics/traits of an entrepreneur
3.1.4T4 Role of an entrepreneur in an enterprise

Practice

3.1.4P0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to:

a) assess his or her entrepreneurial potential
b) write a profile on a successful entrepreneur in the locality.

Content

3.1.4P1 Trainees to do self-assessment exercise on their entrepreneurial potential
3.1.4P2 Visit a successful entrepreneur within the locality and write a profile on him.

3.1.5 ENTREPRENEURIAL OPPORTUNITIES

Theory

3.1.5T0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to:

a) define a business idea
b) explain ways of generating business ideas
c) explain the various sources of business ideas
d) outline and evaluate business opportunities.
e) explain ways of matching entrepreneurial Competence with
f) business.

Competence

The trainee should have the ability to identify and evaluate a business opportunity.

Content

3.1.5T1 Business idea
3.1.5T2 Generation of business ideas
3.1.5T3 Sources of business ideas
3.1.5T4 Identification and evaluation of Business opportunities
3.1.5T5 Ways of matching entrepreneurial Competence and matching with business opportunities

Practice

3.1.5P0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to:

a) generate business ideas
b) evaluate business opportunities.

Content

3.1.5P1 Brainstorming on business ideas
3.1.5P2 Business opportunity evaluation

3.1.6 STARTING A SMALL BUSINESS

Theory

3.1.6T0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to:

a) explain the different forms of business ownership
b) explain the factors to be considered when starting a small enterprise
c) explain the procedure of starting a small enterprise
d) explain the business life cycle
e) outline challenges that are faced when starting a small enterprise
f) state business resources.

Competence
The trainee should have the ability to set up a small enterprise.

Content

3.1.6T1 Forms of business ownership
3.1.6T2 Factors to be considered when starting a small enterprise
3.1.6T3 Procedure of starting a small enterprise
3.1.6T4 Business life cycle
3.1.6T5 Challenges faced when starting a small enterprise
3.1.6T6 Business Resources

Practice

3.1.6P0 *Specific Objective*
By the end of the sub module unit, the trainee should be able to illustrate a business life cycle, using a diagram.

Content

3.1.6P1 Illustration of a business life cycle

3.1.7 ENTERPRISE MANAGEMENT

Theory

3.1.7T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:

a) define enterprise management
b) explain ways by which various resources in an enterprise should be
c) managed
d) outline ways of managing business finances
e) describe business records
f) state business support services
g) explain relevant marketing activities in a small enterprise.

Competence
The trainee should have the ability to properly manage a small business enterprise.

Content

3.1.7T1 Definition of terms
3.1.7T2 Managing of the enterprise resources
3.1.7T3 Managing the business finances
3.1.7T4 Business records
3.1.7T5 Business support services
3.1.7T6 Marketing activities in a small enterprise

Practice

3.1.7P0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:

a) use various resources to manage a business
b) keep business records.

Content

3.1.7P1 Assist a business enterprise in locality to manage business resources

3.1.7P2 Management of business records

3.1.8 ENTERPRISE SOCIAL RESPONSIBILTIES

Theory

3.1.8T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) explain the meaning of enterprise social responsibility
b) explain the importance of enterprise social responsibility
c) outline the social concerns of an enterprise.

Competence
The trainee should have the ability to integrate business enterprise with the society.

Content

3.1.8T1 Meaning of enterprise social responsibility

3.1.8T2 Importance of enterprise social responsibility

3.1.8T3 Social concerns of an enterprise

Practice

3.1.8P0 *Specific Objective*
By the end of the sub module unit, the trainee should be able to undertake a relevant community social activity.

Content

3.1.8P1 Participate in a community social activity within the locality

3.1.9 BUSINESS PLAN

Theory

3.1.9T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) explain a business plan
b) state the components of a business plan.

Competence
The trainee should have the ability to write a plan for a business.

Content

3.1.9T1 Business plan

3.1.9T2 Components of a business plan

Practice

3.1.9P0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) collect relevant data to enable him/her write a business plan
b) write a business plan.

Content
3.1.9P1 Trainee to go out and collect data relevant to his/her business plan area
3.1.9T2 Writing business plan

3.1.10 INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) IN ENTREPRENEURSHIP

Theory

3.1.10T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) explain the benefits of ICT to a small enterprise
b) describe the use of computer application software in a small business.

Competence
The trainee should have the ability to use ICT in a business enterprise

Content
3.1.10T1 Benefits of ICT to a small business enterprise
3.1.10T2 Use of a computer application in a small business enterprise

Practice

3.1.10P0 *Specific Objective*
By the end of the sub module unit, the trainee should be able to identify benefits of ICT in a small business enterprise

Content
3.1.10P1 Visit a small business enterprise with ICT and identify benefits of ICT

3.1.11 EMERGING TRENDS IN ENTREPRENEURSHIP

Theory

3.1.11T0 Specific Objectives
By the end of the sub module unit, the trainee should be able to:
a) state the emerging trends in entrepreneurship
b) explain the challenges posed by the emerging trends and issues in entrepreneurship

c) outline ways of managing challenges posed by emerging trends and issues in entrepreneurship.

Content

3.1.11T1 Emerging trends in enterprise management

3.1.11T2 Challenges posed by emerging trends and issues

3.1.11T3 Management of challenges posed by emerging trends and issues in entrepreneurship

Suggested Learning Activities

- Discussions
- Visits to existing businesses and customers, Chamber of Commerce, trade fairs and exhibitions
- Preparation of business records
- Brainstorming on types of technologies used
- Personal interviews
- Case studies
- Simulation
- Field visits

Suggested Learning Resources for the entire unit

- Television and radios
- Manuals, newspapers and business journals
- Guest speaker

Suggested Methods Assessment

- Question and answer
- Presentation
- Field report
- Continuous Assessment Test (CAT)
- Written examination

4.1.0 INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)

4.1.01 Introduction

This module unit is intended to equip the trainee with knowledge; skills and attitudes to enable him/her appreciate and apply Information and Communication Technology in every day life.

4.1.02 General Objectives

At the end of the course unit, the trainee should be able to:

a) understand Information and Communication Technology
b) and Operating Systems
c) understand techniques of data processing
d) appreciate the role of Information and Communication
e) Technology (ICT) in organizations and life in general
f) understand the principles of operation of a computer and
g) operating systems
h) adapt to emerging trends in Information and
i) Communication Technology (ICT).

4.1.03 Module Unit Summary and Time Allocation

Information and Communication Technology (ICT)

Code	Sub Module Units	Content	Total Hrs
4.1.1	Introduction to Ict	• Concept of ICT • Functions of ICT • History of computers • Classification of computers • Components of a computer	8
4.1.2	Computer Hardware	• Input devices • Output devices • Central Processing Unit (CPU) • Peripherals • Storage Media	6
4.1.32	Computer	• Software concept	6

	Software	• Types of software • Functions of computer software	
4.1.4	Operating System	• Operating systems • Function of operating systems • Operating system commands • Managing disks •	6
4.1.5	Data Security and Control	• Definition of data security and privacy • Security threats and control measures • Computer crimes • Detection and protection against computer crimes • Laws governing protection of ICT	8
4.1.6	Word Processing	• Concepts of word processing • Functions of word processing • Document creation and manipulation • Tables creation and manipulation • Mail merging • Apply word processing utilities •	14
4.1.7	Spread Sheets	• Meaning of spread sheet • Uses of spread sheets • Preparing worksheet layout • Building worksheet • Manipulating data on worksheet • Data application to cells • Formulae and function • Charts	12
4.1.8	Database	• Meaning of database	12

		• Database design • Data manipulation • Data sorting and indexing • Data storage • Data retrieval • Data security	
4.1.9	Networking and Internet	• Meaning of networks • Functions of networks • Networks configuration • Meaning and uses of internet • Electronic Mail (e-mail)	8
4.1.10	Desktop Publishing	• Functions of • Tools used • Manipulations • Enhancements of typeset work • Printing of documents	10
4.1.11	Presentation Packages	• Types of presentation packages • Creating slides • Formatting slides • Running slides • Editing objects • Printing slides and handouts	6
4.1.12	Emerging Trends And Issues in ICT	• Emerging trends and issues in Information Communication Technology • Challenges posed by the emerging trends and issues in Information and Communication Technology • Coping with challenges posed by emerging trends and issues in Information and Communication Technology	4
Total Time			**100**

4.1.1 INTRODUCTION TO INFORMATION COMMUNICATION TECHNOLOGY (ICT)

Theory

4.1.1T1 Specific Objectives

By the end of the sub module unit, the trainee should be able to:

a) describe the concept of ICT
b) describe the functions of ICT
c) discuss the history of computers
d) classify computers
e) identify components of a computer.

Competence

The trainee should have the ability to:

i) Identify the various types of computers
ii) Identify parts of a computer
iii) Connect computer peripherals
iv) Maintain the computer system

Content

4.1.1T1 Concept of ICT
4.1.1T2 Functions of ICT
4.1.1T3 History of computers
4.1.1T4 Classification of computers
i) super computers
ii) main frames
iii) mini computers
iv) micro computers
v) desktops
vi) laptops
vii) palm top
4.1.1T5 Components of computers
v) computer hardware
vi) computer software

Practice

4.1.1P1 Specific Objectives

By the end of the sub module unit, the trainee should be able to:

a) discuss types of computers
b) identify components of a computer

Content

4.1.1P1 Group discussion on types of computers
4.1.1P2 Identification of computer components and parts

4.1.2 COMPUTER HARDWARE

Theory

4.1.2T0 Specific Objectives

By the end of the sub module unit, the trainee should be able to:

a) identify hardware components of a computer
b) describe input devices
c) describe output devices

d) describe central processing unit (CPU)
e) identify storage media
f) describe peripherals.

Competence

The trainee should have the ability to:

i) Identify computer hardware
ii) Classify memory
iii) Select computer hardware
iv) Test hardware
v) Install hardware
vi) Maintain hardware

Content

4.1.2T1 Computer hardware components

4.1.2T2 Input devices
- i) keyboard
- ii) mouse
- iii) scanner
- iv) bar code reader
- v) magnetic card input
- vi) voice input devices

4.1.2T3 Output devices
- i) monitor (visual display unit)
- ii) printer
- iii) sound output device

4.1.2T4 Central Processing Unit (CPU)
- i) electronic components of CPU
- ii) computer bases

4.1.2T5 Storage media
- i) primary (main) memory
- ii) Radom Access Memory(R.A.M.)
- iii) Read Only Memory(R.O.M.)
- iv) secondary storage device
- v) tapes
- vi) cassettes
- vii) diskette
- viii) flash disks
- ix) optic media
- x) compact disks (CDs)
- xi) video Compact disks (VCD)
- xii) digital Video Disks (DVD)

4.1.2T6 Computer peripherals

Practice

4.1.2P0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to:

a) identify input and output devices of a computer
b) identify storage media of a computer
c) start and restart the computer
d) demonstrate competence in keyboard skills
e) demonstrate competence in mouse skills.

Content

4.1.2P1 Identification of input and output devices

4.1.2P2 Identification of storage media of a computer

4.1.2P3 Starting and restarting the computer
i) cold booting
ii) warm booting

4.1.2P4 Keyboard skills
i) functional keys
ii) alphanumeric keys
iii) special keys
iv) cursor movement keys
v) numeric keypad

4.1.2P5 Mouse skills
i) clicking
ii) double clicking
iii) dragging
iv) right clicking
v) scrolling

4.1.3 COMPUTER SOFTWARE

Theory

4.1.3T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) explain the concept of software
b) classify computer software
c) describe functions of computer software.

Competence
The trainee should have the ability to:
- Identify type of computer software
- Select computer software
- Utilize computer system
- Maintain software
- Install software
- Launch software
- Upgrade software

Content

4.1.3T1 Software concept

4.1.3T2 Classification of computer software
i) system software
ii) application software
iii) programming language

4.1.3T3 Functions of computer software

Practice

4.1.3P0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to install basic computer software.

Content

4.1.3P1 Installation of basic computer software

4.1.4 OPERATING SYSTEMS

Theory

4.1.4T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) explain how operating systems work

b) explain how operating systems commands work
c) explain how to manage disks.

Competence

The trainee should have the ability to:

i) Identity an Operating System (OS)
ii) Describe an operating system
iii) Compare an operating systems
iv) Select an operating system
v) Utilize OS systems
vi) Install OS
vii) Maintain an operating

Content

4.1.4T1 Working of an operating system
i) starting
ii) shutting
iii) customizing

4.1.4T2 Operating systems commands
i) Directories/folders management
ii) Creating
iii) Moving and copying
iv) Renaming
v) Selecting
vi) Opening folder
vii) ii) File management
viii) Creating
ix) Moving and copying
x) Renaming and deleting
xi) Opening and closing
xii) Searching

4.1.4T3 Managing disks
i) Assigning a volume label
ii) Checking disk storage state
iii) Formatting
iv) Copying
v) Scanning

Practice

4.1.4P0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to:

a) demonstrate competence in the use of an operating system
b) apply various operating system commands
c) manage disks.

Content

4.1.4P1 Using an operating system
i) starting an operating system
ii) shutting down an operating system
iii) customizing an operating system

4.1.4P2 Operating system commands
i) Directories/folders management
ii) creating
iii) moving and copying

iv) renaming and selecting
v) opening a folder
vi) File management
vii) creating
viii) moving and copying
ix) renaming and deleting
x) opening and closing a file
xi) searching and sorting files

4.1.4P3 Managing disks
i) assigning a volume label
ii) checking disk storage status
iii) formatting a disk
iv) copying a diskette (disk copy)
v) scanning of disks

4.1.5 DATA SECURITY AND CONTROL

Theory

4.1.5T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) define data security and privacy
b) identify security threats on ICT and possible control measures
c) identify types of computer crimes
d) explain how to detect and protect identified computer crimes
e) discuss laws governing protection of Information and Communication Technology.

Content

4.1.5 T 2 Security threats and control measures
4.1.5 T 3 Computer crimes
4.1.5 T 4 Detection and protection against computer crimes
4.1.5 T 5 Laws governing protection of ICT

Practice

4.1.5 P0 *Specific Objectives*
By the end of the sub-module the trainee should be able to:
a) identify security threats on ICT and possible control measures
b) identify types of computer crimes
c) detect and protect identified computer crimes.

Content

4.1.5P 1 Security threats and control measures
4.1.5P 2 Computer crimes
4.1.5P 3 Detection and protection against computer crimes

4.1.6 WORD PROCESSING

Theory

4.1.6T0 Specific Objectives

By the end of the sub module unit, the trainee should be able to:

a) explain concepts in word processing
b) describe the procedure of creating and manipulating
c) documents
d) explain how to create and manipulate tables
e) explain mail merging techniques
f) describe word processing utilities.

Competence

The trainee should have the ability to:

i) Create a word document
ii) Edit a word document
iii) Format a document
iv) Print a document
v) Create a :
- Letter
- Memo
- Poster
- Advert
- Menu

vi) Merge documents
vii) Save / Open a document

Content

4.1.6T1 Concepts in word processing
i) File
ii) Save
iii) Word wrap
iv) Delete

4.1.6T2 Document creation and manipulation
i) create a document
ii) save a document
iii) format a document
iv) retrieve a document
v) delete a document
vi) edit a document
vii) print a document

4.1.6T3 Tables creation and manipulation
i) tables
ii) insert rows and columns
iii) create cells
iv) sizing
v) entering texts and formatting
vi) borders and shading
vii) lines
viii) drawing
ix) editing
x) entering
xi) print

4.1.6T4 Mail merge
i) create a main document
ii) create a data resource document
iii) merging process
iv) merge the information to a file
v) print individualized documents

4.1.6T5 Application of word processing utilities
i) search and replace
ii) grammar checker

iii) the sources
iv) book marks
v) sorting and selecting
vi) line sort
vii) paragraph sort
viii) merge sort
ix) table sort
x) spell check

Practice

4.1.6P0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) start a word processing package
b) create a document
c) format and style documents
d) create multi columned documents
e) create and edit tables
f) apply word processing graphics
g) print documents.

Content

4.1.6P1 Starting a word processing package
i) parts of a word processing window
ii) exiting a word processing package

4.1.6P2 Document creation
i) Creating a new document
ii) Editing a document
iii) Saving, closing and opening a document
iv) Formatting a document

4.1.6P3 Formatting
i) Character formatting
ii) Bold
iii) Italics
iv) Underline
v) Fonts (size, style, colour)
vi) Paragraph formatting
vii) alignment
viii) indentation
ix) spacing
x) page breaks
xi) bullet and numbering
xii) change case
xiii) Page formatting
xiv) page layout
xv) page set up
xvi) page numbering
xvii) Headers and footers
xviii) Foot notes and end notes

4.1.6P4 Creation of multicolumn document
i) Create columns
ii) Manipulate columns
iii) column width
iv) column spacing
v) column lines
vi) column breaks
vii) balancing columns
viii) converting columns

4.1.6P5 Creating and editing tables
i) ways of creating a table
ii) entering data
iii) resizing
iv) editing tables
v) inserting rows and columns

vi) merging and splitting cells
vii) deleting rows, columns and table
viii) enhancing tables
ix) -borders and shading
x) performing calculations

4.1.6P6 Word processing graphics
i) inserting pictures
ii) drawing objects
iii) creating and editing text boxes

4.1.6P7 Printing
i) Printer set up -selecting a printer
ii) print settings
iii) Printer connection
iv) Print options
v) printer status
vi) print range
vii) multiple pages
viii) copies
ix) Print preview
x) display
xi) one page
xii) full screen
xiii) multiple pages
xiv) magnify
xv) ruler
xvi) print
xvii) close
xviii) Printing a document

4.1.7 SPREAD SHEETS

Theory

4.1.7T0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to:
a) explain the meaning of a spread sheet
b) identify areas where spreadsheets are applied
c) explain worksheets layout
d) explain how to build and save a worksheet
e) manipulate data in a worksheet
f) explain how to apply cell data types
g) explain formulae and functions
h) explain use of charts.

Competence

The trainee should have the ability to:
i) Create a spreadsheet
ii) Edit a spreadsheet
iii) Format a spreadsheet
iv) Save/open a spreadsheet
v) Use formula
vi) Use statistical functions/Analysis
vii) Use macros in spreadsheet
viii) Perform calculations
ix) Print spreadsheet

Content

4.1.7T1 Meaning of a spreadsheet

4.1.7T2 Areas where spreadsheets are applied

4.1.7T3 Demonstration of worksheet layouts
- i) columns
- ii) rows
- iii) cells

4.1.7T4 Building and saving a worksheet
- i) build/enter simple worksheets
- ii) save a worksheet file
- iii) exit a worksheet file
- iv) insert numbers
- v) insert text
- vi) insert simple formulae

4.1.7T5 Data manipulation on worksheet

4.1.7T6 Data application to cell

4.1.7T7 Formulae and function

4.1.7T8 Use charts

Practice

4.1.7P0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to:
- a) start a spreadsheet package
- b) enter and edit data in a worksheet
- c) edit a worksheet
- d) format a worksheet
- e) apply formulae and functions
- f) apply spreadsheet charts
- g) print worksheet and charts.

Content

4.1.7P1 Starting a spreadsheet package
- i) loading and running a spreadsheet package
- ii) parts of spreadsheet window
- iii) exiting a spreadsheets package

4.1.7P2 Entering and editing data
- i) entering numbers, text and formulae
- ii) editing data
- iii) selecting data in a worksheet
- iv) canceling selected areas
- v) copying and moving data
- vi) deleting data

4.1.7P3 Editing a worksheet
- i) inserting and deleting rows, columns and worksheets
- ii) naming worksheets
- iii) adjusting column width and row height
- iv) freezing rows and columns

4.1.7P4 Formatting a worksheet
- i) formatting cells and worksheet data
- ii) copying and deleting formats
- iii) conditional formatting

4.1.7P5 Applying formulae and functions
- i) types of formulae
- ii) rules of entering formulae

iii) copying and moving of formulae
iv) cell references
v) parts and layout of a function
vi) entering a function

4.1.7P6 Working with charts
i) creating charts
ii) chart types
iii) modifying/editing charts
iv) formatting charts

4.1.7P7 Printing
i) printing a worksheet
ii) printing a selection

4.1.8 DATABASE

Theory

4.1.8T0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to:

a) explain the meaning of database
b) describe the database design
c) explain how to carry out data manipulation
d) explain how to use various software for data sorting and indexing
e) explain how to store data appropriately
f) explain how to retrieve data
g) discuss how to uphold data security.

Competence

The trainee should have the ability to:

i) Create a database
ii) Enter data into a database
iii) Manipulate in a database
iv) Create tables, forms, queries and reports

Content

4.1.8T1 Meaning of database
i) data
ii) database
iii) databank

4.1.8T2 Data base design
i) field name
ii) field type
iii) field width
iv) field table

4.1.8T3 Data manipulation
- editing

4.1.8T4 Data sorting
i) ascending order
ii) descending order
iii) selective sorting

4.1.8T5 Data storage

4.1.8T6 Data retrieval
i) meaning
ii) processes

4.1.8T7 Data security
i) threats/hazards
ii) data security controls
iii) ergonomics

Practice

4.1.8P0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to:

a) apply database concepts
b) design database structure
c) apply queries
d) use forms in entering data
e) apply reporting and labeling
f) print tables, forms, queries and reports.

Content

4.1.8P1 Application of database concepts
- i) field name
- ii) records
- iii) files
- iv) database

4.1.8P2 Designing a database structure (table)
- i) field name
- ii) field type
- iii) field width
- iv) data entry
- v) saving the table in the database
- vi) editing the table
- vii) appending records
- viii) insertion
- ix) deletion
- x) altering the table
- vii) sorting and indexing

4.1.8P3 Application of querying
- i) single field condition
- ii) multiple field condition
- iii) logical operators
- iv) AND
- v) OR
- vi) NOT

4.1.8P4 Application of forms
- i) form design layout
- ii) using forms to enter data

4.1.8P5 Application of reporting and labeling
- i) form design layouts
- ii) tabular
- iii) columnar
- iv) modifying a report
- v) 4.1.8P6 Printing
- vi) printing tables
- vii) printing queries
- viii) printing forms
- ix) printing reports

4.1.9 NETWORKING AND INTERNET

Theory

4.1.9T0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to:
a) explain the meaning of computer networks
b) explain functions of networks
c) describe types of networks
d) explain how to carry out network configuration
e) describe internet and internet uses
f) explain the e-mail concept.

Competence

The trainee should have the ability to:

i) Identify network resources
ii) Share resources over the network
iii) Identify network types
iv) Differentiate between internet and www
v) Identify internet addresses
vi) Use browsers
vii) Use search energies
viii) Surf the net
ix) Create e-mail accounts and their facilities
x) Print documents

Content

4.1.9T1 Meaning of computer networks
4.1.9T2 Functions of networks
4.1.9T3 Types of networks
i) Local Area Network (L.A.N.)
ii) Metropolitan Area Network (M.A.N.)
iii) Wide Area Network (W.A.N.)
iv) others
4.1.9T4 Configuration of networks
i) tools
ii) process
4.1.9T5 Internet and internet uses
i) internet browsing
ii) searching techniques
4.1.9T6 Electronic mail (e-mail)
i) email address
ii) creating email messages
iii) sending and reading messages
iv) using the address book
v) organizing email messages

Practice

4.1.9P0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to:
a) connect to the internet
b) browse the internet
c) apply electronic mail concepts
d) carryout network configurations.

Content

4.1.9P1 Connecting to the internet
i) leased line
ii) dial up
iii) wireless
4.1.9P2 Browsing the internet
i) internet browsers
ii) website addresses
iii) search engines
iv) search techniques
4.1.9P3 Application of electronic mail
i) e-mail address
ii) creating e-mail messages
iii) sending and reading messages
iv) attaching files to e-mail messages
v) using the address book

vi) organizing e-mail messages

4.1.9P4 Configurations of network

4.1.10 DESK TOP PUBLISHING (DTP)

4.1.10T0 *Specific Objectives*

By the end of the module unit, the trainee should be able to:

a) explain how to identify the different icons and tools used in DTP
b) explain page layout
c) explain how to open, save and close files
d) explain how to draw various shapes using DTP
e) explain application of colour pellets
f) explain how to insert text from within
g) explain how to import and export text
h) explain object linking and embedding
i) explain how knowledge is applied in design and output scenario.

Competence

The trainee should have the ability to use Desk Top Publishing tools to produce a document

Content

4.1.10T1 Identification of various icons used in DTP
- i) Concepts of desktop publishing
- ii) Loading a DTP application

4.1.10T2 Explanation of page layout (margins, paper sizes, page
- i) formatting)
- ii) Margins
- iii) Paper size
- iv) Page formatting

4.1.10T3 Starting a new page in DTP, saving the setup, retrieving it and closing files
- i) Start a new page
- ii) Save a page

4.1.10T4 Drawing various shapes using DTP
- i) Moving shapes
- ii) Resizing shapes
- iii) Cropping

4.1.10T5 Application of the use of colour pellets to enhance a document
- i) Demonstration of colour pellet
- ii) Style pellet
- iii) Control pellet

4.1.10T6 How text is inserted from within
- i) Procedures for insertion
- ii) Locating the source
- iii) Identifying the destination

4.1.10T7 Importing and exporting text from other sources
- i) Identifying source and destination

4.1.10T8 Explanation of objects linking and embedding.
i) Object linking
ii) Embedding procedures

4.1.10T9 Knowledge application learned in design and output Scenario
i) Designing functional items like:
- Business cards
- Posters and flyers
- Wedding cards
- Calendars

Practice

4.1.10P0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) identify the different icons and tools used in DTP
b) determine page layout
c) open, save and close files
d) draw various shapes using DTP
e) apply the use of colour pellets
f) insert text from within
g) import and export text
h) link and embed object
i) apply knowledge in design and output scenario.

Content

4.1.10P1 Identification of various icons used in DTP
i) Concepts of desktop publishing
ii) Loading a DTP application

4.1.10P2 Determination of page layout (margins, paper sizes, page
i) formatting)
ii) Margins
iii) Paper size
iv) Page formatting

4.1.10P3 Starting a new page in DTP, saving the setup, retrieving it and
i) closing files
ii) Start a new page
iii) Save a page

4.1.10P4 Drawing various shapes using DTP
i) Moving shapes
ii) Resizing shapes
iii) Cropping

4.1.10P5 Application of the use of colour pellets to enhance a document
i) Demonstration of colour pellet
ii) Style pellet
iii) Control pellet

4.1.10P6 Inserting text from within
i) Procedures for insertion
ii) Locating the source
iii) Identifying the destination

4.1.10P7 Importing and exporting text from other sources
- Identifying source and destination

4.1.10P8 Object linking and embedding.

i) Object linking
ii) Embedding procedures

4.1.10P9 Application of the knowledge learned in design and output
i) Scenario
ii) Designing functional items like:
- Business cards
- Posters and flyers
- Wedding cards
- Calendars

4.1.11 PRESENTATION PACKAGES

Theory

4.1.11T0 *Specific Objectives*

By the end of the sub module unit the trainee should be able to:
a) discuss various types of presentation packages
b) explain how to create slides
c) explain how to format slides
d) explain how to run slides
e) describe how to edit objects
f) describe how to print slides and handouts.

Competence

The trainee should have the ability to:
i) Create slides
ii) Format slides
iii) Edit slides
iv) Run the presentation
v) Print the slide and handout

Content

4.1.11T1 Types of presentation packages
4.1.11T2 Creating slides
4.1.11T3 Formatting slides
4.1.11T4 Running slides
4.1.11T5 Editing objects
4.1.11T6 Printing slides and handouts

Practice

4.1.11P0 *Specific Objectives*

By the end of the sub module unit the trainee should be able to:
a) open presentation packages
b) create slides
c) format slides
d) run slides
e) edit objects
f) printing slides and handouts.

Content

4.1.11P1 Opening a presentation package
4.1.11P2 Creating slides
4.1.11P3 Formatting slides
4.1.11P4 Running slides
4.1.11P5 Editing objects
4.1.11P6 Printing slides and handouts

4.1.12 EMERGING TRENDS AND ISSUES IN INFORMATION AND COMMUNICATION TECHNOLOGY

Theory

4.1.12T0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to:

a) explain how to identify emerging trends and issues in Information and Communication Technology
b) explain the challenges posed by emerging trends and issues in Information and Communication Technology
c) explain ways of coping with challenges posed by emerging trends and issues in Information and Communication Technology.

Content

4.1.12T1 Emerging trends and issues in Information and Communication Technology

4.1.12T2 Challenges posed by emerging trends and issues in information and communication technology

4.1.12T3 Ways of coping with challenges posed by emerging trends and issues in information and communication technology

Practice

4.1.12P0 *Specific Objective*

By the end of the sub module unit the trainee should be able to discuss the emerging trends and issues in information and communication technology

Content

4.1.12PT1 Group discussion on the emerging trends and issues in Information and Communication Technology

Suggested teaching and learning resources for the entire unit

i) Computer (Complete with peripherals and accessories)
ii) Data storage devices
iii) Printer
iv) Internet services
v) Cameras and scanners
vi) Electricity
vii) LCD projector

Suggested teaching and learning teaching / Learning Activities for the unit

i) Demonstrations
ii) Lectures
iii) Illustrations
iv) Field visits
v) Case studies
vi) Field work
vii) Question and Answer
viii) Presentations
ix) Browsing Internet

Suggested Evaluation Methods for this Unit

i) Written tests
ii) Practical tests
iii) Observations
iv) Quizzes
v) Oral presentation
vi) Written Examination

5.1.0 COURSE FOUNDATIONS AND GENERAL INFORMATION

5.1.01 Introduction

This module unit is intended to equip the trainee with the basic requisites and foundation in Craft in Electrical Engineering and the general information required for understanding the concepts of the trade.

5.1.02 General Objectives

By he end of the module unit, the trainee should be able to:

a) acquire knowledge on occupational and training opportunities available locally and internationally.
b) understanding the meaning and importance of ethics and integrity in the electrical and electronic field.
c) demonstrate ability in material handling and waste disposal.
d) develop the culture of maintenance.
e) acquire knowledge of electrical materials and tools.

5.1.03 Module Unit Summary and Time Allocation

Course Foundations and General Information

Code	Module Units	Sub-Units	Time Hrs
5.1.1	Occupation Information	• Opportunities available • Training institutions • Electrical trade licenses • Role of Kenya Bureau of standards (KEBS)	2
5.1.2	Ethics and Integrity	• Importance of ethics and integrity • How values are acquired, • developed and sustained • Significance of values in society	4
5.1.3	Materials Handling And	• Methods of handling • materials	6

	Waste Disposal	• Methods of disposing waste materials	
5.1.4	Culture of Maintenance	• Culture of maintenance • Need for maintenance • Types of maintenance	4
5.1.5	Electrical Tools	• Tools used in electrical and electronic • engineering • Care and maintenance of tools	8
5.1.6	Electrical Materials	• Classes of electrical materials • Applications of electrical materials	6
5.1.7	Quqlity Control	• Meaning of quality control • Factors contributing to marketability of products • Advantages of good workmanship • Procedure of the work process	6
Total Time			**38**

5.1.1 OCCUPATION INFORMATION

Theory

5.1.1T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to acquire Information on:

a) opportunities available in this career
b) list types of training institutes
c) state types of electrical trade licenses
d) state the role of Kenya Bureau of Standards(KEBS).

Content

5.1.1T1 Opportunities available in this career
- i) Formal
- ii) Informal

5.1.1T2 Training institutions
- i) Universities
- ii) Polytechnics
- iii) Technical training institutions
- iv) Institutes of technology
- v) Youth polytechnics

5.1.1T3 Electrical trade licenses

5.1.1T4 Role of Kenya Bureau of Standards (KEBS)
- i) Setting standards
- ii) Verify standards

Suggested Learning Resources
- i) Board (chalk/white)
- ii) KEBS manual
- iii) Teachers notes
- iv) Visits to other learning institutions

5.1.2 ETHICS AND INTEGRITY

Theory

5.1.2 T0 Specific Objectives

By the end of the sub-module unit, the trainee should be able to:

a) explain ethics and integrity
b) state the importance of ethics
c) describe how values are acquired, developed and sustained
d) explain the significance of values in society.

Content

5.1.2 T1 Stating the importance of ethics and integrity
- Importance of ethics

5.1.2 T2 The meaning of integrity
- Importance of integrity

5.1.2 T3 How values are acquired, developed, and sustained Morality
- Religion and its influence in the society

5.1.2 T4 The significance of values in the society
- i) Individual
- ii) Society

Suggested Learning Resources

i) Text books
ii) Teachers notes
iii) Ethics and integrity act

5.1.3 MATERIAL HANDLING AND WASTE DISPOSAL

Theory

5.1.3T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) list various methods of handling materials appropriately
b) outline methods of disposing waste materials

Competence

The trainee should have the ability to:

i) Handle electrical and electronics materials safely
ii) Identify appropriate methods of disposing various engineering materials.

Content

5.1.3T1 Methods of handling materials appropriately
i) delicate electronics components
ii) chemicals
iii) radioactive materials
iv) heavy materials

5.1.3T2 Methods of disposing waste materials
i) burning: carbonation using materials (paper)
ii) burying: broken glass, recycling

Practice

5.1.3P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) identify appropriate methods of handling materials
b) demonstrate ways of disposing waste appropriately.

Content

5.1.3P1 Appropriate methods of handling materials
i) heavy materials
ii) delicate materials

5.1.3P2 Appropriate methods of disposing waste
i) type of materials
ii) consider recycling

5.1.4 CULTURE OF MAINTENANCE

Theory

5.1.4T0 Specific Objectives

By the end of the sub-module unit, the trainee should be able to:

a) explain the meaning of culture of maintenance
b) explain the need for maintenance
c) describe types of maintenance.

Content

5.1.4T1 Culture of maintenance
- i) To embrace
- ii) To practice

5.1.4T2 Need for maintenance
- i) tools
- ii) materials
- iii) equipment
- iv) structure
- v) components
- vi) maintaining health standards
- vii) avoiding deterioration or decay of the Components/materials/tools/equipment

5.1.4T3 Types of maintenance
- i) Routine maintenance
- ii) Preventive maintenance
- iii) Planned maintenance

Suggested Learning Resources
- i) Charts
- ii) Tools
- iii) Equipment

5.1.5 ELECTRICAL TOOLS

Theory

5.1.5T0Specific Objectives

By the end of the sub-module unit, the trainee should be able to:

a) list tools commonly used in Electrical and Electronics Engineering
b) explain care and maintenance of various tools.

Competence

The trainee should have the ability to:
- i) Select the right tools for the right job
- ii) Maintain various tools in the electrical field

Content

5.1.5T1 Tools used in Electrical and Electronic Engineering.

5.1.5T2 Explaining care and maintenance of tools
- i) caring
- ii) cleaning techniques
- iii) Servicing (oiling / greasing)

Practice

5.1.5P0 Specific Objectives

By the end of the sub-module unit, the trainee should be able to:

a) illustrate safe application of tools commonly used in

electrical and electronics engineering
b) perform maintenance of tools in the workshop and other working places.

Content

5.1.5P1 Safe Application Of Tools Used In Electrical Workshop
- i) Cutting tools
- ii) Stripping tools
- iii) Fastening tools
- iv) Fixing tools
- v) Soldering tools
- vi) Holding tools
- vii) Other general purpose tools

5.1.5P2 Maintenance of Tools
- i) Right tool for the right job
- ii) caring
- iii) cleaning techniques
- iv) servicing (oiling/greasing)
- v) storage

Suggested Learning Resources
- i) Various tools in the electrical field
- ii) Tools' cleaning and maintaining aids

5.1.6 ELECTRICAL MATERIALS

Theory

5.1.6T0 Specific Objectives

By the end of the sub-module unit, the trainee should be able to:
a) state different classes of electrical materials
b) state typical applications of electrical materials.

Competence

The trainee should have the ability to:
- i) Identify various classes of electrical materials
- ii) Apply various electrical materials in electrical and electronics works

Content

5.1.6T1 Classes of electrical materials
- i) Conductors
- ii) Copper
- iii) Aluminum
- iv) Silver
- v) Insulators
- vi) PCP
- vii) PVC
- viii) Rubber
- ix) Glass
- x) Asbestos
- xi) Semi- conductors
- xii) germanium
- xiii) Silicon

5.1.6T2 Applications of electrical materials
- i) Conductors - Cables/bus bars
- ii) Insulation- Insulation/sheath

iii) semi conductor - diodes /transistors

Practice

5.1.6P0 Specific Objectives

By the end of the sub-module unit, the trainee should be able to:

a) identify different classes of electrical materials
b) apply different classes of electrical materials in electrical work.

Content

5.1.6P1 Classes of electrical materials

i) Conductors
ii) Copper
iii) Alluminium
iv) silver
v) insulators
vi) mineral
vii) polychloroprene (PCP)
viii) paper
ix) polyvinylchloride(PVC)
x) rubber
xi) glass
xii) asbestos
xiii) semi- conductors
xiv) germanium
xv) silicon

5.1.6P2 Applications of electrical materials

i) Conductors - Cables/bus bars
ii) Insulation- Insulation/sheath
iii) semi conductor - diodes /transistors

Suggested Learning Resources

i) Various electrical materials
ii) Semiconductor materials
iii) Semi conductor components

5.1.7 QUALITY CONTROL

Theory

5.1.7T0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to:

a) explain the meaning of quality control
b) outline the procedure of the work process
c) enumerate the advantages of good workmanship
d) list factors contributing to marketability of product.

Competence

The trainee should have the ability to:

i) Select good materials to produce a quality product
ii) Select proper tools and equipments to be used to produce a quality product

iii) Determine factors leading to the production of the production of a quality product.
iv) Determine the marketability of a quality product
v) Select a quality product from a given sample

Content

5.1.7T1 Meaning of quality control

5.1.7T2 Procedure of the work process
- sequence of activities

5.1.7T3 Advantages of good workmanship
i) quality products
ii) customer satisfaction

5.1.7T4 Factors contributing to marketability of products
i) durability
ii) finishing
iii) quality of selected materials
iv) intended purpose

Practice

5.1.7P0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) control the work process
b) ensure good workmanship
c) produce marketable products.

Content

5.1.7P1 Control the work process sequencing activities

5.1.7P2 Ensure good workmanship
i) quality products
ii) customer satisfaction

5.1.7P3 Produce marketable products
i) durability
ii) finishing
iii) quality of selected materials
iv) serves intended purpose

Suggested Learning Resources
i) Kenya bureau of standards manual
ii) SI standards reference manual
iii) Other stands and code of regulation manuals for the electrical and electronic technology trade

6.1.0 TECHNICAL DRAWING

6.1.01 Introduction

This module unit is intended to equip the trainee with knowledge, skills and attitudes to enable him/her apply technical drawing techniques in drawing and interpretation of electrical drawings.

6.1.02 General Objectives

By the end of the module unit, the trainee should be able to:

a) understand the importance of engineering drawing
b) demonstrate the trainee should have the ability to use engineering drawing techniques
c) interpret electrical and electronic drawings
d) understand common symbols used in architectural drawings.

6.1.03 Module Summary and Time Allocation

Technical Drawing

Code	Sub-Module Unit	Content	Time Hrs
6.1.1	General Communication	• Importance of engineering drawing • Artistic drawings • Identification, use and care for various drawing instruments and materials • Setting up a drawing paper • Drawing quality lines	2
6.1.2	Plane Geometry	• Construction of various geometrical shapes • Construction of tangents to circles • Construction of Loci • Reduction and enlargement	4
6.1.3	Pictorial Drawing	• Isometric drawings of given solid objects • Oblique drawings of given solid objects	5

6.1.4	Orthographic Projection	• Third angle projection • First angle projection	4
6.1.5	Free Hand Sketching	• Sketching techniques	2
6.1.6	Dimensioning	• Dimensioning of orthographic views and pictorial • Interpreting drawings in engineering	4
6.1.7	Sectioning	• Sectional views • Sectioning exception • Sectional views in first and third angle orthographic projections	4
6.1.8	Assembly Drawing	• Sectional assembly drawing • Dimensions for assembly drawings	4
6.1.9	Solid Geometry	• Construction of parallel lines • Construction of radial lines development • Construction of lines of intersections • Construction of triangulation development	4
6.1.10	Electrical Drawing	• Graphical symbols British Standards (BS) 3939 • Block diagrams • Wiring diagrams • Schematic diagrams	4
6.1.11	Architectural Drawings	• Symbols • Electrical installation • Machine layout • Lighting schemes	4
6.1.12	Electronic Drawing	• Printed Circuit Board (PCB) • Chassis drawing and fasteners	4
6.1.13	Computer Related Drawings	• Linear design solutions • 2Dimentional and 3Dimentional (2D and 3D) designs	10
Total Time			**55**

6.1.1 GENERAL COMMUNICATION

6.1.1P0 Specific Objectives

By the end of the sub-module unit, the trainee should be able to:

a) state the importance of engineering drawing
b) identify, use and care for various drawing instruments and materials
c) correctly set up a drawing paper
d) print alphabetical letters and numbers
e) draw quality lines.

Competence

The trainee should have the ability to communicate through pictures and writing.

Content

6.1.1P1 Importance of engineering drawing
- i) artistic drawings
- ii) scaled drawings
- iii) sketches
- iv) site plans

6.1P 2 Identification use and care for various drawing instruments and materials
- i) drawing boards
- ii) instruments
- iii) drawing machines
- iv) scales
- v) pencils (all types and grades)
- vi) drawing papers
- vii) tracing papers

6.1. P3 Set up a drawing paper
- i) Instruments
- ii) layout and preparation
- iii) boarder lines
- iv) title block
- v) hidden lines
- vi) centre lines
- vii) construction lines

6.1. P4 Free hand printing
- i) letters
- ii) numbers

6.1. P5 Quality lines
- i) boarder line
- ii) outlines
- iii) hidden lines
- iv) centre lines

Suggested Learning/Teaching Resources
- i) Drawing instruments
- ii) Drawing materials
- iii) Drawing equipment

6.1.2 PLANE GEOMETRY

6.1.2P0 Specific Objectives

By the end of the sub-module unit, the trainee should be able to:

a) construct various geometrical shapes
b) construct tangents to circles
c) construct loci
d) reduce or enlarge figures by construction method

e) construct given figures to other shapes of equal area.

Competence

The trainee should have the ability to apply plane geometry in the electrical and electronic trade.

6.1.2P1 Construction of various geometrical shapes
Bisection of lines
i) Bisection of angles
ii) Various geometrical shapes

6.1.2P2 Construction of tangents to circles
i) Inscribed circles
ii) Subscribed circles
iii) Bisection of lines
iv) Bisection of angles

6.1.2P3 Construction of Loci
i) Ellipses
ii) Involutes
iii) Cycloids
iv) Cams
v) Parabola
vi) Hyperbola
vii) Archimedia spiral
viii) Cycloid
ix) Epicycloids

6.1.2P4 Reduction and enlargement

6.1.2P5 Shapes of equal area

Learning/Teaching Resources

i) Drawing equipment
ii) Drawing instruments
iii) Drawing materials

6.1.3 PICTORIAL DRAWING

6.1.3P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) draw isometric drawings of given solid objects
b) draw oblique drawings of given solid objects
c) construct perspective drawings of given solid objects.

Competence

The trainee should have the ability to:

- Make drawings of solid objects using various methods.

Content

6.1.3P1 Drawing isometric drawings of given solid objects
i) 290 receding lines
ii) Isometric box (boxing method of construction)
iii) Isometric circles (4 centre method)
iv) Exercises on isometric drawings for cavalier and cabinet

6.1.3P2 Drawing Oblique Drawings of Given Solid Objects
i) Oblique box
ii) Circles and arcs

iii) Picture plane
iv) Horizon line

6.1.3P43 Perspective Drawings of Given Solid Objects
i) Vanishing points
ii) Stationary points
iii) Line of site
iv) Single line perspective
v) Two line perspective
vi) Drawing exercises

Learning/Teaching Resources
i) Drawing equipment
ii) Drawing instruments
iii) Drawing materials
iv) Models of solid objects

6.1.4 ORTHOGRAPHIC PROJECTION

6.1.4P0 *Specific* Objectives
By the end of the sub-module unit, the trainee should be able to:
a) draw given objects in third angle projection
b) draw given objects in first projection.

Content

6.1.4P1 Third Angle Projection
i) Placement of views
ii) Front
iii) Plan
iv) End
v) Projections symbols

6.1.4P2 First Angle Projection
i) Placement of views
ii) Front
iii) Plan
iv) End
v) Projections symbols
vi) Drawing exercises

Competence
The trainee should have the ability to produce various types of views for solid objects.

Learning/Teaching Resources
i) Drawing equipment
ii) Drawing instruments
iii) Drawing materials

6.1.5 FREE HAND SKETCHING

6.1.5P0 *Specific Objective*
By the end of the sub-module unit, the trainee should be able to make pictorial sketches of common electrical tools and accessories.

Content

6.1.5P1 Sketching Techniques
i) Neatness
ii) Proportionality
iii) Hand tools
iv) Electrical/electronics components
v) Accessories
vi) Symbols

Learning/Teaching Resources
i) Drawing equipment
ii) Drawing instruments
iii) Drawing materials
iv) Electrical tools

v) Electrical accessories, components and equipment

6.1.6 DIMENSIONING

6.1.6P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to;

a) dimension orthographic views and pictorial drawings
b) interpret drawings in engineering and architectural drawings.

Competence

The trainee should have the ability to show sectional views of various objects

Content

6.1.6P1 Dimensioning of orthographic views and pictorial drawings
- i) Overall dimensions
- ii) Major dimensions
- iii) Circles and arcs
- iv) Lines

6.1.6P2 Interpreting drawings in engineering
- i) Detailed dimensions
- ii) Architectural drawing dimensions

Competence

The trainee should have the ability to:

i) Dimension various engineering drawing
ii) Interpret dimensions for architectural drawings

Learning/Teaching Resources

i) Drawing equipment
ii) Drawing instruments
iii) Drawing materials

6.1.7 SECTIONING

6.1.7P0 Specific Objectives

By the end of the sub-module unit, the trainee should be able:

a) identify various sectional views
b) identify sectioning exceptions
c) draw sectional views in first angle and third angle orthographic projections.

Content

6.1.7P1 Identification of various sectional views
- i) Full sections
- ii) Half sections
- iii) off set sections
- iv) Revolved section
- v) Removed section
- vi) Slugged section

6.1.7P2 Identification of sectioning exception
- i) Webs
- ii) Shafts
- iii) Keys and key ways
- iv) Bolts and washers
- v) Rivets and pins

vi) Hatching lines

6.1.7P3 Drawing sectional views in first and third angle orthographic projections
- i) Full sectioned drawings
- ii) Half sectioned drawings
- iii) Cutting plans

Learning/Teaching Resources
- i) Drawing equipment
- ii) Drawing instruments
- iii) Drawing materials

6.1.8 ASSEMBLY DRAWING

6.1.8P0 Specific Objectives

By the end of the sub-module unit, the trainee should be able to:
- a) draw sectional assembly drawing
- b) dimension assembly drawings.

Content

6.1.8P1 Sectional assembly drawing
- i) Hatching lines
- ii) Sectioning of different lines
- iii) Hidden details (not required)
- iv) Oven all dimensions
- v) Parts list

6.1.8P2 Dimensions for assembly
Assembly drawings
-drawings

Competence

The trainee should have the ability to assemble and make drawings for sectional objects

Learning/Teaching Resources
- i) Drawing equipment
- ii) Drawing instruments
- iii) Drawing materials

6.1.9 SOLID GEOMETRY

6.1.9P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:
- a) construct parallel line development
- b) construct radial lines development
- c) construct lines of intersections
- d) construct triangulation development.

Competence

The trainee should have the ability to;
- i) Make surface development of various objects
- ii) Establish the plan/shape of the surface area of objects.

Content

6.1.9P1 Construction of Parallel Lines
- i) Truncated cylinders
- ii) Truncated prisms

iii) True shapes and elevations
iv) Outlines and bending lines\
v) Truncated cones
vi) Truncated pyramids

6.1.9P2 Construction of Radial Lines Development
i) Two lines and elevations
ii) Outlines and bending lines

6.1.9P3 Construction of Lines of Intersections
i) Intersections of similar cylinders, prisms and pyramids
ii) Intersections of dissimilar cylinders and prisms
iii) Intersections of cylinders and pyramids
iv) Development of intersecting solids

6.1.9P4 Construction of Triangulation Development
i) Transition pieces
ii) Simple in – line development between:
iii) Transition pieces of different cross sections
iv) Cylinders and square pyramids

Learning/Teaching Resources
i) Drawing equipment
ii) Drawing instruments
iii) Drawing materials

6.1.10 ELECTRICAL DRAWING

6.1.10P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:
a) identify the standard graphical symbols
b) draw block diagrams of electrical and electronic circuits
c) draw wiring diagrams
d) draw schematic diagram.

Competence

The trainee should have the ability to:
i) Draw electrical and electronics drawings
ii) Correctly interpret electrical and electronics drawings

Content

6.1.10P1 Graphical symbols
British Standards (BS) 3939
i) Kenya Bureau of Standards (KEBS)
ii) Installation/electronics symbols BS 3939
iii) Logic symbols
iv) Symbols
v) Resistors
vi) Switch
vii) Inductor
viii) Coil
ix) Capacitor

x) Lighting point
xi) Electric bell

6.1.10P2 Block diagrams of:
i) Purpose
ii) Motor control circuits
iii) Power supply units
iv) Electric motor final circuit
v) DOL starter
vi) Forward reverse
vii) Operation
viii) Inching operation
ix) Star delta starter
x) Resistance starter
xi) Call and alarm circuits
xii) Single line wiring diagrams

6.1.10P3 Wiring Diagrams for:
i) Lighting systems
ii) Use of graphical symbols
iii) Planning the circuits
iv) Standard circuit representation

6.1.10P4 Schematic Diagrams of:
i) Lighting circuits
ii) Alarm systems
iii) Communication systems
iv) Motor control circuits
v) Amplifiers
vi) Converting block diagrams to schematic and vice-versa

6.1.11ARCHITECTURAL DRAWINGS

6.1.11P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:
a) draw common symbols used in architectural drawings
b) draw layout of electrical installation in buildings
c) draw layout of machines in a workshop
d) design and draw lighting scheme in building.

Content

6.1.11P1 Symbols
i) windows
ii) doors
iii) water closet
iv) walls
v) staircase
vi) beams

6.1.11P2 Electrical Installation
i) conduct runs
ii) lighting points
iii) power points

6.1.11P3 Machine Layout
i) Ducts systems
ii) Trunking System

6.1.11P4 Lighting Schemes
i) Drawings
ii) Spacing

Competence

The trainee should have the ability to:
iv) Draw electrical functional architectural drawing

v) Interpret architectural drawing

6.1.12ELECTRONIC DRAWING

6.1.12P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) prepare Printed Circuit Board (PCB) for practical use
b) draw chassis drawing and fasteners
c) draw electronics circuit diagrams.

Competence

The trainee should have the ability to:

i) Prepare printed circuit board for electronics circuits
ii) Draw chassis drawing and fasteners
iii) Interpret printed circuit board for electronics circuits
iv) Interpret chases drawing and fasteners

Content

6.1.12P1 PCB Drawing

i) Drilling drawing
ii) Assembly of components
iii) Chassis drawing
iv) Types
v) Designs
vi) Box, VT and I pattern

6.1.12P2 Chassis Drawing and Fasteners

6.1.12P3 Drawing Electronic Circuit Diagrams

i) Point and point diagrams
ii) Base line diagram
iii) Highway diagram
iv) Lineless diagrams

Learning/Teaching Resources

i) Printed Circuit Boards (PCB)
ii) Electronic components
iii) resistors
iv) transistors
v) inductors
vi) Manuals
vii) Etching equipment

6.1.13 COMPUTER RELATED DRAWINGS

6.1.13P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) use computer to carry out linear designs solutions
b) use computer to carry out 2D and 3D designs
c) carry out isometric designs

d) use computer to draw electrical and electronic drawings
e) use computer to simulate electronic circuits.

Content

6.1.13P1 Linear design solutions
i) Auto cad
ii) Archi cad

6.1.13P2 2d and 3d designs
- WIZs

6.1.13P3 Isometric designs
i) NW isometric
ii) NE isometric
iii) SE isometric

7.1.0 MATHEMATICS I

7.1.01 Introduction

The module unit is designed to equip the trainee with the relevant mathematical knowledge, skills, techniques and attitudes necessary to enhance better understanding of his/her trade.

7.1.02 General Objectives

By the end of the module unit, the trainee should be able to:

a) use mathematical concepts and techniques in solving problems related to electrical and electronic engineering
b) organize and draw simple deductions and conclusions from a given data.
c) interpret graphical representation of functions relevant to electrical activities.

7.1.03. Module Unit Summary and Time Allocation

Mathematics I

Code	Sub-Module Unit	Content	Time Hrs
7.1.1	Number System	• Types of numbers • Operation on integers • Number as products of prime factors • Greatest Common Divider/Highest Common Factor (GCD/HCF) of a set of numbers • Lowest Common Divider (LCM of a set of numbers • Application of GCD and LCM	4
7.1.2	Fractions and Decimals	• Types of fractions • Operation on fractions • Application of fractions • Operation on decimals • Numbers in standard form • Rounding off numbers	4

		• Fractions to decimals • Application of fractions and decimals	
7.1.3.	Indices and Logarithms	• Laws of indices • Indicial equations • Laws of logarithms • Logarithmic equations • Conversion of numbers from one base to another • Scientific calculator	8
7.1.4	Matrices	• Definition of a matrix • Operation on matrices • Inverse of a 2 x 2 matrix • Solution of simultaneous equations by matrix method	10
7.1.5	Sequence and Series	Sequence and series Solution on problems involving series Simple and compound interest	8
7.1.6	Statistics	Definition Data collection Data organization Frequency distribution table Data presentation Central tendency Data interpretation Variance and Standard deviation Data computation	10
Total			**44**

7.1.1 NUMBER SYSTEM

7.1.1T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:

a) identify the various types of numbers
b) carry out arithmetic operation on integers
c) express numbers as products of prime factors
d) find the G.C.D/H.C.F of a set of numbers
e) find the L.C.M. of a set of numbers
f) apply the knowledge of G.C.D and L.C.M in real life situations.

Content

7.1.1T1 Types of numbers
7.1.1T2 Operation on integers
7.1.1T3. Numbers as product of
- Prime factors

7.1.1T4 G.C.D/H.C.F of a set of numbers
7.1.1T5 L.C.M of a set of numbers
7.1.1T6 Application of G.C.D and L.C.M to real life situations

7.1.2 FRACTIONS AND DECIMALS

7.1.2T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:

a) identify various types of fractions
b) perform the four operations on fractions in the correct order
c) apply fractions to real life situations
d) perform the four basic operations on decimals in the correct order
e) express numbers in their standard form
f) round off numbers to the required number of decimal places
g) convert fractions to decimals and vice versa
h) apply the knowledge of decimals and fractions to real life situations.

Content

7.1.2T1 Types of fractions
7.1.2T2 Operation on fractions
7.1.2T3. Application of fractions to real life situations
7.1.2T4 Operation on decimals
7.1.2T5 Numbers in standard form
7.1.2T6 Rounding off numbers to the required number of decimal places

7.1.2T7 Conversion of fractions to decimals and vice versa

7.1.2T8 Application of fractions and decimals

7.1.3 INDICES AND LOGARITHMS

7.1.3T0 *Specific Objectives*
By the end of this unit, the trainee should be able to:

a) state the laws of indices
b) apply the laws of indices in calculations
c) state the laws of logarithms
d) apply the laws of logarithms in calculations
e) convert numbers from one base to another
f) use a scientific calculator.

Content

7.1.3T1 Laws of indices
i) Multiplication
ii) Division
iii) The root
iv) The negative indices

7.1.3T2 Indicial equations

7.1.3T3. Laws of logarithms
i) Multiplication
ii) Division
iii) Powers
iv) Roots

7.1.3T4 Logarithmic equations

7.1.3T5 Conversion of numbers from one base to another
i) Decimal/denary
ii) Duodecimal
iii) Binary

7.1.3T6 Scientific calculator usage

7.1.4 MATRICES

7.1.4T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:

a) define a matrix
b) carry out operations on matrices
c) determine the inverse of a 2x2 matrix
d) apply matrices in solving simultaneous equations.

Content

7.1.4T1 Matrix

7.1.4T2 Operation on matrices

7.1.4T3. Inverse of a 2x2 matrix

7.1.4T4 Solution of simultaneous equations by matrices

7.1.5 SEQUENCE AND SERIES

7.1.5T0 *Specific Objectives*
By the end of the sub-module unit, the

trainee should be able to:

a) distinguish between a sequence and a series
b) solve problems involving series
c) apply the knowledge of series in calculating simple and compound interest.

Content

7.1.5T1 Sequence and series
7.1.5T2 Solution of problems involving series
  i) Arithmetic progression
  ii) Geometric progression
7.1.5T3 Simple and compound interest

7.1.6 STATISTICS

7.1.6T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) define statistics
b) collect data
c) organize data
d) draw a frequency distribution table
e) present data
f) calculate measures of central tendency
g) interpret data from real life situations
h) determine the variance and standard deviation of given a set of data
i) compute the quartiles, percentiles and deciles of a given set of data.

Content

7.1.6T1 Definition of statistics
7.1.6T2 Data collection
  i) Process of data collection
  ii) Data collection in the field
7.1.6T3. Data organization
  i) Types of data
  ii) Data tabulation
7.1.6T4 Frequency distribution tables
7.1. 6T5 Data presentation
  i) Line graphs
  ii) Bar graphs
  iii) Pie charts
  iv) Pictograms
  v) Histograms
  vi) Frequency polygons
7.1.6T6 Measures of central tendency
  i) Mode
  ii) Median
  iii) Mean
7.1.6T7 Data interpretation
7.1.6T8 Variance and standard deviation
7.1.6T9 Quartiles, percentiles and deciles

8.1.0 APPLIED SCIENCE

8.1.01 Introduction

The module unit is intended to equip the trainee with the knowledge, skills and attitudes to enable him/her apply engineering science relevant to electrical Engineering.

8.1.02 General Objectives

By the end of the module unit, the trainee should be able to:

a) apply relevant principles of applied science in solving engineering problems
b) carry out experiments to verify scientific principles
c) demonstrate correct skills in data collection, analysis and interpretation.

8.1.03 Module Unit Summary and Time Allocation

Applied Science

Code	Sub Module Unit	Content	Total
8.1.1	Foundations of Chemistry	• Properties of matter • Properties and effects of acids and bases • Properties and uses of Salts • Atomic structure • Chemical bonding	14
8.1.2	Light and Sound	• Laws of reflection and refraction of light • Refraction of light through various media • Refractive indices of various media • Location of images formed by mirrors and lenses • Power magnification and magnification power of instruments • Principle of operation of optical instruments • Polarization of light and its applications	8

		• Propagation and properties of sound • Sound levels	
8.1.3	Heat	• Temperature and temperature scales and conversions • Types of thermometers • Forms of heat transfer • Determine heat capacities and latent heat • Terms used in calorimetry • Graphs of change of state • Applications of heat capacity and latent heat	8
8.1.4	Density and Pressure	• Terms used for solids, liquids and gases. • Determination of densities • Archimedes principle, law of floatation and buoyancy • Calculation of density from relative density • Problems involving Archimedes principle and Law of floatation • Pressure and types of pressure • Pressure in solids, liquids and gases • Calculation of pressure • Methods and instruments of measuring pressure • Practical applications of pressure	8
8.1.5	Work, Energy, Power and Machines	• Definitions of terms and units • Forms, sources and types of energy • Law of conservation of energy • Problems involving work, energy and power • Calculations of potential energy (PE) and Kinetic Energy (KE) and the law of conservation of energy • Simple machines • Calculations of Mechanical Advantage (MA), Velocity Ratio (VR) and efficiency • Determination of the law of the	14

		machine • Problems involving practical examples of simple machines	
8.1.7	Magnetism and Electro-Magnetism	• Terms used in magnetism • The compass • Lines of flux around a magnet • Electromagnetism • Electromagnetic induction • Laws and rules of electromagnetic induction • Self induction • Applications of electromagnetic induction	8
8.1.8	Electro-Statics	• Definition of electrostatics • Types of charge and methods of charging objects • Sources of electrostatic charges • Basic law of charge • Capacitors and capacitance	4
8.1.9	Electro Magnetic Radiation	• Definition of terms • Properties of electromagnetic waves • Methods of producing and detecting radiations • Cathode Ray Oscilloscope (CRO)	4
Total time			**68**

8.1.1 FOUNDATIONS OF CHEMISTRY

Theory

8.1.1T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) state the properties of matter.
b) describe the properties and effects of acids and bases
c) describe the properties and uses of salts
d) describe atomic structure of elements
e) explain chemical bonding of elements.

Competence

The trainee should have the ability to:

i) Prepare and work safely with chemicals
ii) Use the periodic table of elements
iii) Verify applied science principles and apply them to ship systems
iv) Use common optical instruments
v) Track and identify weather patterns
vi) Carry out tests on metals and alloys

Content

8.1.1T1 Properties of matter
i) Elements
ii) Compounds
iii) Mixtures
iv) Polarization
v) Ionization energies

8.1.1T2 Properties and effects of acids and bases:
i) Type of Indicators
ii) pH
iii) Oxides
iv) Hydroxides

8.1.1T3 Properties and uses of Salts
i) Solubility
ii) Conductivity
iii) Effect of heat
iv) Preparation:
v) Neutralization
vi) Precipitation

8.1.1T4. Atomic structure of elements
i) Structure of an atom
ii) Electric configuration
iii) Atomic Spectra
iv) Bohr Theory
v) Spectral Series
vi) Atomic number
vii) Periodicity

8.1.1T5 Chemical Bonding of Elements
i) Types of bonding
ii) Hydrogen
iii) Covalent
iv) Metallic
v) Co-ordinate

vi) Van der Waal
vii) Simple Molecules
viii) Mole concept
ix) Chemical equations
x) Thermo chemical equations
xi) Acid /base equations
xii) Redox equations
xiii) Bonding in carbon compounds
xiv) Covalent bonding formation
xv) Hybridization.

Practice

8.1.1P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) identify and test acids and bases
b) perform neutralization experiments
c) prepare salts.

Content
8.1.1P1 Identification Of Acids And Bases
8.1.1P2 Neutralization
8.1.1P3 Salts

8.1.2 LIGHT AND SOUND

Theory

8.1.2T *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) state and explain laws of reflection and refraction of light
b) describe refraction of light through various media
c) determine refractive indices of various media
d) locate images formed by mirrors and lenses
e) determine power magnification of lenses and magnification power of instruments
f) explain the principle of operation of optical instruments
g) explain polarization of light and describe its applications
h) explain propagation of sound and its properties.
i) explain sound levels, their measurement, effects and application to noise and noise pollution.

Content
8.1.2T1 Laws of reflection and refraction of light
8.1.2T2 Refraction of light through various media
i) triangular prisms

ii) rectangular prisms
iii) fluids
iv) convex and concave prisms.

8.1.2T3 Refractive indices of various media
i) liquids
ii) solids (glass)
iii) gases (air)

8.1.2T4 Locating images formed by mirrors and lenses
i) plane mirrors
ii) curved mirrors
iii) lenses
iv) convex
v) concave

8.1.2T5 Power magnification of a lens and the magnification power of instruments
i) lenses
ii) microscopes
iii) projectors
iv) binoculars
v) periscopes
vi) telescope

8.1.2T6 Principle of operation of optical instruments
i) lens formula
ii) images formed by lenses and mirrors
iii) power magnification and magnification power of lenses
iv) microscopes
v) telescopes
vi) projectors
vii) periscopes
viii) binoculars

8.1.2T7 Polarization of light
i) Production
ii) Glare reduction
iii) Photo elasticity
iv) Application of polarized light
v) Projecting images
vi) Projecting light
vii) Safety in use of
viii) polarized light

8.1.2T8 Propagation and properties of sound
i) Media
ii) air
iii) solids
iv) liquids
v) Properties
vi) refraction
vii) diffraction
viii) absorption
ix) interference

8.1.2T9 Sound levels
i) Measurement
ii) sound intensity
iii) sound pressure levels
iv) Tolerable pressure levels
v) Sound pressure meter
vi) Effects
vii) media effects
viii) room design
ix) applications
x) noise pollution
xi) noise reduction
xii) mufflers
xiii) dampers
xiv) acoustics
xv) ship whistle

Practice

8.1.2P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) perform an experiment to calculate the velocity of sound
b) perform experiments to measure sound levels.

Content

8.1.2P1 Velocity of sound
- Echo method

8.1.2P2 Sound levels measurement

8.1.3 HEAT

Theory

8.1.3T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) describe various temperature scales and conventions
b) describe various types of thermometers
c) describe forms of heat transfer
d) solve problems involving heat capacities, specific heat capacities and latent heat
e) define terms used in calorimetry
f) describe methods of determining heat capacities and latent heat
g) plot and interpret graphs of change of state
h) explain applications of heat capacity and latent heat.

Content

8.1.3T1 Temperature and temperature scales
i) Absolute scale
ii) Celsius scale
iii) Fahrenheit scale
iv) Kelvin scale
v) Temperature scales conversions

8.1.3T2 Types of thermometers
i) Mercury in glass
ii) Pyrometers
iii) Constant volume gas

8.1.3T3 Forms of heat transfer:
i) Conduction
ii) Convection
iii) Radiation
iv) Black body radiation
v) Ultraviolet (u.v.) and infrared (i.r.) Radiation
vi) Transmission
vii) Absorption
viii) Reflection

8.1.3T4 Calculations for quantity of
i) heat
ii) Heat capacity
iii) Specific heat capacity

iv) Latent heat

8.1.3T5 Terms used in calorimetry
- i) Heat
- ii) Specific heat capacity
- iii) Heat capacity
- iv) Latent heat of:
- v) Fusion
- vi) Vaporization/condensation
- vii) Sublimation

8.1.3T6 Methods of determining heat capacities and latent heat
- i) Mixture method
- ii) Electrical method

8.1.3T7 Change of state graphs

8.1.3T8 Applications of heat capacity and latent heat
- i) Refrigeration
- ii) Heat exchangers

Practice

8.1.3P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to perform experiments involving heat transfer, heat capacities, specific heat capacities and latent heat.

Content

8.1.3P1 Heat transfer experiments:
- i) Heat transfer
- ii) Heat capacity
- iii) Specific heat capacity
- iv) Latent heat

8.1.4 DENSITY AND PRESSURE

Theory

8.1.4T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
- a) explain the terms applied to density and pressure
- b) determine densities of solids, liquids and gases
- c) explain Archimedes principle, law of floatation and buoyancy
- d) apply Archimedes principle and law of floatation to
- e) solve problems related to density and pressure
- f) calculate density from relative density
- g) describe various types of pressure.
- h) describe pressure in solids, liquids and gases
- i) perform calculations involving pressure.

j) describe instruments of measuring pressure
k) explain practical applications of pressure.

Content

8.1.4T1 Terms used for solids, liquids and gases
i) Density
ii) Relative density
iii) Specific gravity

8.1.4T2 Determination of densities:
i) Solids
ii) Liquids
iii) Gases Solids
iv) Liquids
v) Gases

8.1.4T3 Archimedes Principle, Law of Floatation and Buoyancy

8.1.4T4 Calculation of density from relative density

8.1.4T5 Application of Archimedes Principle and Law of Floatation to solve problems

8.1.4T6 Pressure and types of pressure:
i) Gauge pressure
ii) Absolute pressure
iii) Atmospheric pressure

8.1.4T7 Pressure in:
i) Solids
ii) Liquids
iii) variation with depth/ density (Pascal's Law)
iv) Transmission
v) Forces acting on body in a fluid
vi) Velocity head
vii) Gases

8.1.4T8 Calculations involving pressure:
i) Conversions.
ii) Pascal's Law
iii) Pressure measurements

8.1.4T9 Instruments for measuring pressure
i) Barometer
ii) Manometer

8.1.4T10 Practical applications of pressure
i) Vacuum pump
ii) Hydrometer
iii) Hydraulic pump
iv) Controlled Pitch Propeller(CPP)

8.1.5 WORK, ENERGY, POWER AND MACHINES

Theory

8.1.5T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:
a) define work, energy and power
b) describe energy
c) state the law of conservation of energy
d) solve problems involving work energy and power

e) perform calculation on potential energy, kinetic energy and
f) law of conservation of energy
g) define terms as used in simple machines.
h) explain practical applications of simple machines
i) perform calculations on mechanical advantage, velocity
j) ratio and efficiency
k) determine the law of the machine using graphical and
l) analytical methods
m) solve problems involving practical applications of simple machines

Content

8.1.5T1 Definitions
i) Work
ii) Power
iii) Energy

8.1.5T2 Forms, sources and types of energy

8.1.5T3 The law of conservation of energy

8.1.5T4 Work, energy and power problems
i) Input
ii) Output
iii) Uniform velocity
iv) Variable velocity

8.1.5T5 Calculations of different forms of energy
i) Potential Energy (PE)
ii) Kinetic Energy (KE) (linear and rotating bodies)
iii) law of conservation of energy

8.1.5T6 Terms used in simple machine
i) Mechanical Advantage (MA)
ii) Velocity Ratio (VR)
iii) Efficiency

8.1.5T7 Practical applications of simple machines
i) Pulleys
ii) Levers
iii) Inclined planes

8.1.5T8 Calculations involving:
i) MA
ii) VR
iii) Efficiency

8.1.5T9 Determination of the law of the machine
i) Graphical method
ii) Analytical method

8.1.5T10 Problems involving practical examples of simple machines
i) Pulleys
ii) Levers
iii) Inclined planes

Practice

8.1.5P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to perform experiments

to verify the law of machines using graphical and analytical methods

Content

8.1.5P1 Determination and verification of the law of the machine
- i) Graphical method
- ii) Analytical method

8.1.6 GAS LAWS Theory

8.1.6T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
- a) describe gas laws
- b) derive the ideal gas equation
- c) perform calculations using the gas law equations
- d) explain the index law of expansion of gases.
- e) derive and apply the index law of expansion
- f) plot and interpret graphs for gas laws

Content

8.1.6T1 Gas laws:
- i) Definition of gas
- ii) Gas laws
- iii) Boyle's law
- iv) Charles law

8.1.6T2 The ideal gas equation

8.1.6T3 Calculations using gas laws
- i) Boyle's Law
- ii) Charles' law
- iii) Gas equation and application

8.1.6T4 Index law of expansion
- i) Adiabatic
- ii) Isothermal
- iii) Polytropic
- iv) The characteristic equation of a gas

8.1.6T5 The index law of expansion
- i) derivation
- ii) applications

8.1.6T6 Gas Laws graphs

Practice

8.1.6P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to perform experiments to verify the index law of expansion of gases

Content

8.1.6P1 The index law of expansion of gases

8.1.7 MAGNETISM AND ELECTROMAGNETISM

Theory

8.1.7T0 *Specific Objectives*
By the end of the sub-module unit, the

trainee should be able to;

a) define terms used in magnetism
b) describe the compass
c) plot lines of flux around a magnet
d) define electromagnetism
e) describe electromagnetic induction
f) state laws and rules of electromagnetic induction
g) describe self-induction
h) describe common applications of electromagnetic induction.

Content

8.1.7T 1 Definition of terms used in magnetism
- i) Flux and lines of flux
- ii) Angle of inclination/dip
- iii) Magnetic induction
- iv) 8.1.7T2 The Compass
- v) Earths Magnetic field
- vi) Points of compass

8.1.7T 3 Lines of flux around a magnet

8.1.7T 4 Electromagnetism
- definitions

8.1.7T 5 Electromagnetic induction

8.1.7T 6 Laws and rules of electromagnetic induction
- i) Fleming's Law
- ii) Lenz's Law
- iii) Fleming's right hand rule
- iv) Maxwell's Screw rule

8.1.7T7. Self-induction

8.1.7T8. Common applications of electromagnetic induction
- i) Electric bell
- ii) Induction coil
- iii) Transformers
- iv) Telephones
- v) Speedometer
- vi) Ignition systems etc

Practice

8.1.7P.0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to;

a) Plot lines of flux around a magnet
b) Use a compass

Content

8.1.7P.1 Lines of flux around a magnet

8.1.7P.2 Magnetic compass

8.1.8 ELECTROSTATICS

Theory

8.1.8T0 *Specific Objectives*

By the end of the sub-module unit, the

trainee should be able to:

a) define electrostatics
b) explain methods of charging of objects
c) describe the sources of electrostatic charges
d) explain the basic law of charge.
e) explain the principle of capacitors and capacitance

Content

8.1.8T1 Definition of electrostatics

8.1.8T2 Methods of charging objects

i) Types of charge
ii) Methods

8.1.8T3 Sources of electrostatic charge

i) Ebony
ii) Glass rod
iii) Silk
iv) Fur
v) Plastics

8.1.8T4 Basic Law of charge

8.1.8T5 Capacitors and capacitance

i) Storage of electrical charge
ii) Relationship between
iii) voltage and charge
iv) Capacitor connection
v) Charging and discharging of a capacitor
vi) Energy stored in a Capacitor
vii) Types of capacitors and their
viii) applications

8.1.9 ELECTROMAGNETIC RADIATION

Theory

8.1.9T0 *Specific Objectives*

By the end of this sub module unit, the trainee should be able to:

a) explain the electromagnetic spectrum
b) explain the properties of electromagnetic waves
c) explain methods of producing and detecting electromagnetic radiation
d) Describe the operations and working of a Cathode Ray oscilloscope

Content

8.1.9T1 The electromagnetic spectrum

- Electromagnetic radiation

8.1.9T2 Properties of electromagnetic waves

8.1.9T3 Methods of producing and detecting electromagnetic radiations:

i) X-rays
ii) Gamma rays
iii) Cathode rays

8.1.9T4 The Cathode Ray Oscilloscope (C.R.O.).

vii)

9.1.0 WORKSHOP TECHNOLOGY

9.1.01 Introduction

This module unit is intended to equip the trainee with the necessary knowledge, skill and attitude required to understand the concepts of workshop technology.

9.1.02 General Objectives

At the end of this unit, the trainee should be able to:

a) observe safely rules and regulations in the workshop.
b) acquire knowledge of engineering materials and processes.
c) create awareness of the human aspect of error in handling tools and equipment.
d) appreciate quality of finished products.
e) apply metal processing techniques to produce articles

9.1.03 Module Summary and Time Allocation

Workshop Technology

Code	Sub-Module Unit	Content	Time Hrs
9.1.1	Occupational Safety	• General workshop safety • Causes of accidents • Industrial safety • Classification of fires • Electrical safety • Workshop layout	4
9.1.2	Materials and Processes	• Metals and non- metals • Properties of materials • Extraction process • Finishes and decorative process • Electrical materials and applications • Metal forming processes	10
9.1.3	Metal Shop Tools and Measurements	• Term used in measurement • Marking out techniques • Workshop hand tools	6

Code	Sub-Module Unit	Content	Time Hrs
9.1.4	Joining of Metals	• Mechanical joining of metals • Thermal joining	11
9.1.5	Workshop Machines and Applications	• Workshop machines • Operation of different types • Safety precautions while using various machines	10
9.1.6	Sheet Metal Work	• Common sheet metals • Uses of tools • Forming in sheet metal • Edge treatment of joints • Fabrication machines	14
Total Time			**55**

9.1.1 OCCUPATIONAL SAFETY

9.1.1T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) explain the safety regulations in the workshop
b) describe courses of accidents in a workshop
c) outline legislation regarding industrial safety
d) explain classification of methods of extinguishing fires
e) explain electrical safety in the buildings
f) explain factors considered in workshop layout

Competence

The trainee should have the ability to:

i) Demonstrate the knowledge of safety in work places
ii) Handle a first aid kit
iii) Perform first aid
iv) Identify and sources of accidents and prevent the same
v) Carry out

Content

9.1.1T1 General workshop safety
9.1.1T2 Courses of accidents
9.1.1T3 Industrial safety
i) Factory act
ii) Special regulations
iii) Hazardous areas
9.1.1T5 Classification of fires
i) Fire fighting procedure
ii) Extinguishers
9.1.1T6 Electrical safety
i) Treatment of electric shock
ii) Mouth to mouth
iii) Holger nelson method
9.1.1T7 Workshop layout
i) Factors
ii) Location
iii) Material handling
iv) Storage
v) Safety
vi) Aesthetic
vii) Plan of workmanship
viii) Machine layout
ix) Electrical supply

Practice

9.1.1P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) handle a first aid kit
b) explain safety in a work place
c) identify the sources of accidents and

precautions to be taken in electrical workshop

d) perform first aid.
e) describe the procedure of rescuing victim from a live wire and administer first aid
f) carry out fire extinguishing drills for various classes of fire

Content

9.1.1P1 Workshop rules and regulations
- i) the `dos' and `don'ts'
- ii) good grooming in the workshop
- iii) cleaning
- iv) interpersonal relationship
- v) conduct in the workshop
- vi) safety for others

9.1.1P2 The first aid kit
- i) the need for a first aid kit
- ii) the Content of a first aid kit and their applications
- iii) care for a first aid kit
- iv) Burns
- v) Electric shock
- vi) Cuts and HIV and AIDs prevention
- vii) Toxic materials
- viii) HIV and aids prevention and wound cleaning and dressing
- ix) Assessing the need for a physician

9.1.1P3 Sources of accidents in the workshop and work places
- i) Slippery floors
- ii) Exposed live wires
- iii) Dressing
- iv) Tools handling
- v) Defective tools
- vi) Machines and situations
- vii) Unsafe working habits
- viii) Movements in the workshop

9.1.1P4 Procedures of rescuing a victim from a live wire
- i) Use of dry non conducting material
- ii) Proper positioning of the rescuer and the victim
- iii) Mouth to mouth rescustation (Kiss of life)
- iv) Holger Nielsen method of rescustation.

9.1.1P5 Fire extinguishing drills

9.1.1P6 Fire extinguishers

Suggested Learning Resources
- i) Protective clothing
- ii) First aid kit
- iii) First aid specialist (personnel)
- iv) Teachers notes
- v) Fire extinguishers
- vi) Charts on safety

vii) Resource persons for fire fighting

9.1.2 MATERIALS AND PROCESSES

9.1.2T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) distinguish between metals non metals and alloys
b) explain the properties of engineering materials
c) describe methods of extraction of different materials
d) explain finishes and decorative process of materials
e) explain the properties electrical materials and their applications
f) explain the various methods of metal forming processes

Competence

The trainee should have the ability to:

i) Identify various materials used in the engineering field
ii) Select various materials for various applications
iii) Safety in handling materials in engineering field

Content

9.1.2T1 Metals and non- metals
- i) Metals
- ii) Non metals
- iii) Alloys
- iv) Ferrous metal
- v) Non ferrous metals

9.1.2T2 Properties of materials
- i) Ductility
- ii) Toughness
- iii) Strength
- iv) Hardness
- v) Malleability
- vi) Corrosion
- vii) Resistance
- viii) Heat treatment

9.1.2T3 Extraction process
- i) Iron
- ii) Steel
- iii) Alluminium
- iv) Copper
- v) Bronze
- vi) Plastic materials

9.1.2T4 Finishes and decorative process
- i) Picking and cleaning
- ii) Polishing
- iii) Electroplating
- iv) Colouring
- v) Lacquering
- vi) Enameling
- vii) Etching

9.1.2T5 Electrical materials and applications
- i) conductors and application

ii) insulators and application
iii) semi – conductors and application
iv) properties
v) construction of cables
vi) cable sizes

9.1.2T6 Metal forming processes
i) forging-folding
ii) laundry work/casting
iii) filing, bending treading

Practice

9.1.2P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) identify ferrous and non ferrous materials
b) identify plastics materials
c) identify various types of cables
d) select cable sizes

Content

9.1.2P1 Ferrous material
i) iron
ii) steel
iii) alloy steel

9.1.2P2 Non ferrous materials
i) alluminium
ii) bronze
iii) zinc
iv) copper
v) brass
i) tin

9.1.2P3 Plastic materials
ii) pvc
iii) rubber
iv) mica
v) porcelain
vi) synthetic materials

9.1.2P4 Cables
i) construction
ii) extrusion
iii) drawing
iv) rolling
v) stranding
vi) insulating and sheathing

9.1.2P5 Size
i) selection
ii) ambient temperature
iii) table of current rating
iv) IEE regulations

Suggested Learning Resources
i) metals – ferrous and non ferrous
ii) alloys
iii) plastics
iv) ceramics
v) fibre glass
vi) synthetic materials
vii) rubber
viii) charts
ix) reference books
x) internet

9.1.3 METAL SHOP TOOLS AND MEASUREMENTS

9.1.3T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:

a) define terms used in workshop measurement
b) explain marking out techniques
c) state correct use of workshop tools

Competence

The trainee should have the ability to:

i) Use measuring tools correctly
ii) Use various tools safely
iii) Carry out various metal fitting exercises

Content

9.1.3T1 Term used in measurement

i) scales – linear and non linear
ii) tolerance
iii) limits
iv) fits

9.1.3T2 Marking out techniques

i) line and measurement
ii) use of rulers
iii) vernier caliper
iv) scribers
v) scribing block
vi) vernier height gauge
vii) centre punch
viii) surface plate
ix) micrometer screw gauge
x) angular measurement

9.1.3T3 Workshop hand tools

i) vices
ii) files
iii) saws
iv) hammer
v) chisels
vi) snips
vii) tap and dues

Practice

9.1.3P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) use measuring instruments correctly
b) identify and use marking out tools
c) safely use various workshop cutting tools
d) mark and carry out a given practical exercise
e) maintain tools

Content

9.1.3P1 Ordinary measurement

i) steel rules
ii) inside and outside caliper

9.1.3P2 Precision measurement

i) vernier calipers
ii) micrometers
iii) angle measurements if use protectors
iv) precautions in use of measuring

9.1.3P3 Marking out tools

i) scriber, divider, centre punch surface plat, angle place, vernier height gauge, protector v-block

9.1.3P4 Precautions in use of marking tools
i) Workshop cutting hand tools
ii) chisels
iii) hacksaw
iv)punches
v) files
vi)Precautions in the use of hand tools

9.1.3P5 Maintenance of tools

Suggested Learning Resources
- work shop tools and equipment

9.1.4 JOINING OF METALS

Theory

9.1.4T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) explain various methods of mechanical jointing of metals
b) explain various methods of thermal joining of metals

Competence
The trainee should have the ability to:
i) Select the right tools for the right job
ii) Use right procedures in metal joining
iii) Observe quality control and safety
iv) Carry out a given exercise correctly within a given time
v) Maintain tools and equipment

Content

9.1.4T1 Mechanical joining of metals
i) Temporary removable joints
ii) Screw – types – threads – applications
iii) Bolts and nuts
iv)Studs and keys
v) Riveting
vi)Pop riveting
vii) Precautions

9.1.4T2 Thermal joining
i) Soldering
ii) Soft soldering
iii) Hard soldering
iv)Brazing
v) Oxy-acetylene welding
vi)Electric arc welding
vii) Necessary pre cautioning

Practice

9.1.4P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) identify tools and equipment used in various mechanical joining of metals
b) identify tools and equipment used in various internal joining of metals
c) use the various tools safety when joining metals
d) join metals using various methods
e) demonstrate safe working habits in metal joining process

Content

9.1.4P1 Mechanical joining
- i) Fasteners screws, bolts and nuts
- ii) Self interlocking joints
- iii) Grooved seam
- iv) Folding seam
- v) Paned seam
- vi) Care of tools and equipment
- vii) Mechanical riveting
- viii) Types of rivets
- ix) Materials
- x) Size

9.1.4P2 Thermal joining
- i) Soldering
- ii) Brazing
- iii) Arc welding
- iv) Sport welding
- v) Seam welding
- vi) Heat sources
- vii) Seam welding
- viii) Filler metal
- ix) Fluxes

9.1.4P3 Safe working habits in metal joining process
- i) Personal
- ii) Others

Suggested Learning Resources
- i) soldering iron
- ii) soldering wire/rod
- iii) rivet grim and rivets
- iv) screws nuts and bolts
- v) oxy – acetylene gas equipment
- vi) drilling machine
- vii) arc welding machine
- viii) blow lamp
- ix) films and posters

9.1.5 WORKSHOP MACHINES AND APPLICATIONS

Theory

9.1.5T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) list various types of workshop machines
b) describe the operation of various workshop machines

c) state necessary safety precautions to be observed while using various workshop machines

Competence

The trainee should have the ability to:

i) Selection of right tools
ii) Perform a given task safely and correctly
iii) Operate given machines correctly
iv) Centre lathe

Content

9.1.5T1 Types of Workshop machines
- i) Drilling machine
- ii) Hand drills
- iii) Centre lathe machine
- iv) Shaping machine
- v) Grinding machine

9.1.5T2 Operation of different types of workshop machines
- i) Methods of work holding
- ii) Drilling
- iii) Turning
- iv) Facing

9.1.5T3 Safety precautions while using various machines

Practice

9.1.5T3 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) select the right tool for the right job
b) perform given tasks using workshop machines
c) demonstrate safe working habits
d) maintain workshop machine

Content

9.1.5P1 Identification of tools
- i) Drilling machine
- ii) Centre lathe
- iii) Pulling machine
- iv) Shaping machine
- v) Grinding machine

9.1.5P2 Operation of machines exercises
- i) Drilling
- ii) Facing
- iii) Turning
- iv) Knurling

9.1.5P3 Demonstrate safe working habit

9.1.5P4 Maintenance of workshop machines

Suggested Learning Resources
- i) drilling machines
- ii) lathe machines
- iii) grinding machines
- iv) necessary tools
- v) instructional sheets

9.1.6 SHEET METAL WORK

9.1.6T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) list common sheet metals
b) explain the application of sheet metal tools
c) explain the process of sheet metal work
d) explain edge treatment of joints in sheet metal work
e) explain the operations of sheet metal fabrication machines

Competence

The trainee should have the ability to:

i) Fabricate a sheet metal project
ii) Maintain tools and equipment

Content

9.1.6T1 Listing common sheet metals
- i) galvanized sheet iron
- ii) tin plate

9.1.6T2 Uses of tools
- i) cutting tools
- ii) forming tools
- iii) marking out tools
- iv) miscellaneous

9.1.6T3 Forming in sheet metal work
- i) meal forming process
- ii) testing squareness
- iii) testing flatness

9.1.6T4 Edge treatment of joints
- i) soldering
- ii) forging
- iii) filling
- iv) binding

9.1.6T5 Sheet metal fabrication machines
- i) shearing machines
- ii) bending machines
- iii) punching machines
- iv) notching machine

Practice

9.1.6P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) interpret drawings in sheet metal work
b) estimate materials for sheet metal work
c) carry out marking out on a piece of sheet metal work
d) identify sheet metal fabrication tools and machines
e) make and assemble part of a given practical exercise on sheet metal
f) demonstrate safely awareness in the use of sheet metal work
g) maintain tools and machines

Content

9.1.6P1 Interpretation of drawing

9.1.6P2 Material estimate from given drawing

9.1.6P3 Marking out procedure

9.1.6P4 Identification of tools

i) Dividers
ii) Punches
iii) Surface plate
iv) Angle plate
v) Vernier height gauge
vi) Protractor
vii) V- block
viii) Machines
ix) Shearing machines
x) Bending machines
xi) Punching machines
xii) Notching machines
xiii) Brakes and roll forming machines

9.1.6 P5 Sheet metal parts making and assembly

9.1.6 P6 Observation of safety

9.1.6 P7 Maintenance of tools and equipment

Suggested Learning Resources

i) various workshop machines and metal tools
ii) folding , vices (bench portable pipe vice)
iii) pipe folding machines
iv) shearing machines

10.1.0 ELECTRICAL PRINCIPLES I

10.1.01 Introduction

This module unit is intended to equip the trainee with knowledge, skills and attitudes to enhance the trainee's understanding of other aspects of electrical and electronic technology. Trainees undertaking this module unit require prior knowledge of basic mathematics.

10.1.02 General Objectives

By the end of the module unit, the trainee should be able;

a) understand the principles of direct current circuits.
b) acquire knowledge in the care and maintenance of chemical cells.
c) apply concepts of electrostatics in electrical circuits
d) understand the theory of magnetism and electromagnetism.
e) apply the principles of transformers in electric machines.

10.1.023 Module Summary and Time Allocation

Electrical Principles I

Code	Sub-Module Unit	Content	Time Hrs
10.1.1	Direct Current Circuits	• Basic electrical quantities and their units • Simple circuit diagrams. • Ohm's law • Determination of resistance of metal conductors • Kirchhoff's laws • Effects of temperature on resistance • Kirchhoff's law	22

10.1.2	Chemical Cells	• Faraday's laws of electrolysis • Construction of cells and their characteristics • Cell connections • Charging methods • Care and maintenance of cells • Effects of internal resistance on terminal voltage	20
10.1.3	Electrostatics	• Electric fields • Construction of capacitors • Definitions of electrostatic quantities and units • Determination of total capacitance • Energy stored in a capacitor	14
10.1.4	Magnetism and Electomagnetism	• Magnetic and non-magnetic materials • Magnetic field patterns • Force on current carrying conductor • Magnetism curve and hysteresis loop • Electromagnetic induction • Inductance in materials	14

10.1.5	Transformers	• Principle of operation of transformers • Types of transformers and their applications • Construction of different types of transformers • Simple calculations on single phase transformers • Transformer impedance matching • Reasons for RF shielding	18
Total Time			**88**

10.1.1 DIRECT CURRENT CIRCUITS

Theory

10.1.1T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) explain the basic electrical quantities and their units
b) draw and interpret simple circuit diagrams
c) state Ohm's law to solve given electrical circuit problems
d) determine the resistance of metal conductors.
e) explain the effects of temperature on resistance
f) apply Kirchhoff's laws to solve given electrical circuit problems

Competence

The trainee should have the ability to:

i) Measure electrical quantities

Content

10.1.1T1 Basic electrical quantities and their units
- i) E.m.f in volts
- ii) Current in amperes
- iii) Resistance in ohms
- iv) Power in watts
- v) Energy in joules

10.1.1T2 Simple circuit diagrams.
- i) The simple electric circuit
- ii) Resistor in parallel
- iii) Series – parallel connection
- iv) Resistors in series

10.1.1T3 Ohm's law
- i) Statement
- ii) Verification
- iii) Resistance circuit calculations
- iv) Power and energy calculations

10.1.1T4 Determination of resistance of metal conductors
- i) Resistivity
- ii) Conductivity
- iii) Length
- iv) Cross – sectional area

10.1.1T5 Effects of temperature on resistance
- i) Definition of temperature coefficient of resistance
- ii) Positive and negative temperature coefficient
- iii) Simple calculations to any base temperature

10.1.1T6 Kirchhoff's laws
- i) Current law
- ii) Voltage law
- iii) Calculations

Practice

10.1.1P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) connect simple electrical circuits and measure various electrical quantities
b) verify Ohm's law
c) demonstrate that the resistance of material depends on area, length and resistivity
d) verify Kirchhoff's law

Content

10.1.1P 1 Measurement of electrical quantities
i) Current
ii) Voltage
iii) Resistance
iv) Power

10.1.1P 2 Verification of Ohm's law

10.1.1P 3 Determination of conductor resistance
i) Resistance
ii) Resistivity
iii) length
iv) Area

10.1.1P 4 Verification of Kirchhoff's laws
i) current law
ii) voltage law

Suggested Learning Resources
i) Dc power source
ii) Assorted resistance
iii) Measuring instruments
iv) Bread boards

10.1.2 CHEMICAL CELLS

Theory

10.1.2T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) State Faraday's laws of electrolysis
b) Describe the construction of cells and their characteristics
c) state methods of cell connections
d) describe charging methods of batteries
e) describe the care and maintenance of batteries
f) explain the effects of internal resistance on terminal voltage

Competence
The trainee should have the ability to:
i) Charge cells
ii) Maintain cells

Content

10.1.2T1 Faraday's laws of electrolysis
i) 1st law
ii) 2nd law

10.1.2T2 Construction of cells and their characteristics

i) Primary – Lec lanche cell
ii) Secondary – lead Acid cell
iii) Alkaline cell

10.1.2T3 Cell connections
i) series connection
ii) parallel connection
iii) series – parallel connections
iv) simple calculations

10.1.2T4 Charging methods
i) constant current
ii) constant voltage
iii) trickle charge
iv) booster charge
v) battery ratings
vi) simple calculations

10.1.2T5 Care and maintenance of cells
i) specific gravity
ii) electrolyte level
iii) terminal voltage
iv) safety precautions
v) storage

10.1.2T6 Effects of internal resistance on terminal voltage – simple calculations

Practice

10.1.2P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) measure total voltage and current of cells connected in series and parallel
b) demonstrate various charging methods
c) determine the internal resistance of cells and show its effect on terminal voltage
d) carry out light maintenance on a battery

Content

10.1.2P1 Measurements of total voltage and current in series and parallel connected cells

10.1.2P 2 Demonstration of various charging methods

10.1.2P 3 Effects of internal resistance on terminal voltage of cell

10.1.2P 4 Maintenance of cells

Suggested Learning Resources
i) Various batteries
ii) Sulphuric acid
iii) Distilled water
iv) Battery chargers
v) Test instruments

10.1.3 ELECTROSTATICS

Theory

10.1.3T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) explain the concept of electric fields
b) describe the construction of

capacitors and their applications
c) define the electrostatic quantities
d) determine the total capacitance for various capacitor connections
e) derive and apply the formula for energy stored in a capacitor

Competence
The trainee should have the ability to:
i) Test a capacitance
ii) Apply capacitors in electrical circuits

Content

10.1.3T1 Electric fields
i) Electric flux
ii) Charge
iii) Potential gradient

10.1.3T2 Construction of capacitors and applications
i) Paper capacitors
ii) Electrolytic capacitors
iii) Ceramic capacitors
iv) Alluminium foil capacitor
v) Polyester capacitor
vi) Tantalum capacitor
vii) Multiplate capacitor
viii) Variable capacitor
ix) Applications

10.1.3T3 Definitions of electrostatic quantities and units
i) Electric flux
ii) Electric flux density
iii) Electric field intensity
iv) Permittivity
v) Capacitance
vi) Charge
vii) Derivation of formula

$$C = \frac{\varepsilon A}{d} = \frac{\varepsilon_r \varepsilon_o A}{d}$$

10.1.3T4 Determination of total capacitance
i) Series connection
ii) Parallel
iii) Series-parallel connection
iv) Calculations

10.1.3T5 Energy stored in a capacitor
i) E = ½ CV2 joules
ii) calculations

Practice

10.1.3P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) identify various types of capacitors
b) measure capacitance in various connections
c) test a capacitor

Content

10.1.3P0 Identification of capacitors

10.1.3P1 Measurement of capacitance
10.1.3P2 Testing of capacitance

Suggested Learning Resources
i) Assorted capacitors
ii) Test instruments
iii) Bread boards

10.1.4 MAGNETISM AND ELECTROMAGNETISM

Theory

10.1.4T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) distinguish between magnetic and non-magnetic materials
b) explain the concepts of magnetic field
c) explain the concept of force on a current carrying conductor in a magnetic field and its applications
d) define the magnetic circuit quantities and their electric circuit equivalents
e) describe the magnetization curve and hysteresis loop
f) explain the concept of electromagnetic induction
g) explain inductance in materials
h) determine total inductance

Competence
The trainee should have the ability to:
i) Construct an electromagnet
ii) Apply magnets in the engineering field

Content
10.1.4T1 Magnetic and non-magnetic materials
i) Molecular arrangements
ii) Field patterns
10.1.4T 2 Magnetic field patterns
i) Permanent magnets
ii) Electromagnets
iii) Single wire
iv) Loop of wire
v) Solenoid
10.1.4T3 Force on current carrying conductor
i) F = BIL
ii) Practical applications
10.1.4T4 Magnetic circuit quantities and their electrical equivalents
i) Magnetic flux
ii) Magneto motive force (m.m.f)
iii) Reluctance
iv) Permeability
v) Series
vi) Parallel
10.1.4T5 Magnetization curve and hysteresis loop
i) B –H curve
ii) Hysteresis loop

iii) Remnant flux
iv) Coercive force
v) Saturation
vi) Energy

10.1.4T6 Electromagnetic induction
i) Self induction
ii) Mutual induction
iii) Faraday's Laws
iv) Lenz's Laws
v) Direction of induced e.m.f

10.1.4T7 Inductance in materials
i) Definition
ii) Unit of inductance
iii) Inductors in series aiding
iv) Energy stored in inductance
v) Calculations

10.1.4T8 Total inductance
i) Aiding
ii) Opposing

Practice

10.1.4P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) Construct electromagnets and verify electromagnetic induction
b) Use magnets in engineering applications
c) Plot B-H curve

Content

10.1.4P1 Construction of electromagnets
i) Ferrous materials
ii) Wire
iii) Power source

10.1.4P2 Use of magnets
i) Bells
ii) Speakers
iii) Solenoids

10.1.4P 3 Plotting of B-H curve

Suggested Learning Resources
i) Permanent magnets
ii) Electromagnets
iii) Power
iv) Wires
v) Bells

10.1.5 TRANSFORMERS

Theory

10.1.5T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) explain the principle of operation of a transformer
b) describe the various types of transformers
c) describe the construction of different types of transformers
d) explain applications of transformers

Competence

The trainee should have the ability to:

i) Test transformers
ii) Construct a single phase transformer

Content

10.1.5T1 Principle of operation of a transformer
- i) Electromagnetic induction
- ii) Magnetic circuit
- iii) Inductance
- iv) Coupling efficiency
- v) Losses

10.1.5T2 Types of transformers and their applications
- i) Single – Phase transformers
- ii) Power transformers
- iii) Audio transformers
- iv) Radio Frequency (R.F) transformers
- v) Auto transformers
- vi) Three phase transformers
- vii) Isolating transformers

10.1.5T3 Construction of different types of transformers
- i) Core type
- ii) Shell type
- iii) Windings

10.1.5T4 Simple calculations on single phase transformers
- i) Transformers ratios
- ii) Efficiency
- iii) Applications of transforms

Practice

10.1.5P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:
- a) Carry out transformer tests
- b) Construct a ingle phase transformer

Content

10.1.5P1 Transformer tests

10.1.5P2 Transformer construction

Suggested teaching/learning resources
- i) Various types of transformers
- ii) Wires
- iii) Electrical measuring instruments
- iv) Electrical tools

11.1.0 ELECTRONICS

11.1.01 Introduction

This module unit is designed to equip the trainee with the necessary knowledge, skills and attitude required to understand the concepts of electronic circuits and their application in related engineering fields.

11.1.02 General Objectives

By the end of this module, the trainee should be able to:

a) understand the theory of semiconductors
b) discuss the components used in electronic circuits
c) acquire knowledge in the operation of electronic circuits
d) develop correct attitude towards career progression in the trade area
e) appreciate changes in electronic technology
f) apply the acquired knowledge in solving electronic and related problems

11.1.03 Module Summary and Time Allocation

Electronics

Code	Sub Module Unit	Content	Hrs
11.1.1	Semiconductor Theory	• Atomic theory • Classification of materials • Intrinsic semiconductors • Extrinsic semiconductors • The p-n junction diode	4
11.1.2	Electronic Components	• Construction of components • Operation of components • Characteristics of components • Application of components	12
11.1.3	Amplifiers	• Transitor configuration • Transistor characteristics • Biasing methods	12

		• Coupling methods • Distortion and noise in amplifiers • Operational amplifiers	
11.1.4	Power Supplies	• Rectification • Smoothing • Regulation • Voltage multipliers • Methods of protection	12
11.1.5	Feedback	• Feedback principle • Positive and negative feedback • Types of negative feedback • Requirements for oscillation • Sinusoidal oscillator circuits	12
11.1.6	Number System And Codes	• Translation of radix • Binary arithmetic • Coding systems • Code conversion • • Application of coding systems	16
11.1.7	Boolean Algebra	• Boolean identities • De Morgan's rules • Simplification of Boolean equations using identities and Karnaugh map • (upto 4-variables)	10
11.1.8	Logic Gates	• Symbols • Truth table • Logic families • Application of logic gates	8
11.1.9	Flip Flops	• Definition of flip-flop • Description of various flip-flops	5

11.1.10	Transducers	• Definition • Construction • Operation • Application	5
11.1.11	Filters	• Operation of filters • Response curves • Application	3
Total Time			**99**

11.1.1 SEMICONDUCTOR THEORY

Theory

11.1.1T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) explain atomic theory
b) classify materials using the energy band diagram
c) describe extrinsic semiconductors
d) describe the p-n junction

Competence
The trainee should have the ability to:
Connect a diode in a circuit

Contents
11.1.1T 1 Atomic theory
i) Element
ii) Compound
iii) Periodic table
iv)Protons
v) Neutrons
vi)Electrons
vii) Orbit
11.1.1T 2 Classification of materials
i) Conductor
i) Semiconductors
ii) Insulators
11.1.1T 3 Intrinsic semiconductors
i) Silicon
ii) Germanium
iii) Covalent bonds
iv) Electron hole pair generation/recombination
v) Intrinsic conduction
11.1.1T4 Extrinsic semiconductors
i) Doping
ii) N- type semiconductor
iii) P- type semiconductor
iv) Extrinsic conduction

11.1.1T 5 The P-N junctions
i) Formation of the junction
ii) Depletion layer
iii) Forward bias

Practice

11.1.1P0 *Specific Objectives*
By the end of the sub module unit the trainee should be able to:
a) identify the terminals of a p-n junction diode
b) connect the P-N junction diode circuit
c) determine the characteristics of the P-N junction diode

Content
11.1.1P1 Identification of the terminals of a P-N junction diode
i) Anode
ii) Cathode

11.1.1T2 Connection of a diode in a circuit
- i) Polarity
- ii) Voltage levels
- iii) establish transistor configuration

11.1.1T3 Characteristics of p-n junction diode
- i) Forward
- ii) Reverse

Suggested Learning Resources
- i) Junction diodes
- ii) Measuring instruments
- iii) Connecting leads
- iv) Power supply units
- v) Accessories
- vi) Electronic tool kit
- vii) Bread boards

11.1.2 ELECTRONIC COMPONENTS

Theory

11.1.2T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
- a) describe the construction of various components
- b) describe the operation of various electronic components
- c) explain characteristics of various electronic components
- d) state the application of various electronic component

Competence
The trainee should have the ability to:
- i) identify electronic components
- ii) test electronic components
- iii) determine component value and rating

Content

11.1.2T1 Description of the construction of electronics components
- i) Resistors
- ii) Capacitors
- iii) Inductors
- iv) Diodes
- v) Bi polar Junction Transistor (BJT)
- vi) Field effect transistors (FETS)
- vii) Triacs
- viii) Thyristors (SCR)
- ix) Photo conductive cells
- x) Photo diodes
- xi) Photo transistors
- xii) Light emitting diodes (LED)
- xiii) Liquid crystal display (LCD)
- xiv) Integrated circuits (ICS)

11.1.2T2 Operation of electronic components

11.1.2T3 Characteristics of electronic components

11.1.2T4 Applications of electronic components

Practice

11.1.2P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) identify various electronic components
b) determine values and ratings of electronic components
c) test various electronic components

Content

11.1.2P1 Identification of various electronic components

11.1.2P2 Values and rating
i) Component size
ii) Colour code
iii) Component Data

11.1.2P3 Testing of electronic component
i) Short circuit
ii) Open circuit
iii) Change in value
iv) leakage

Suggested Learning Resources
i) various components
ii) breadboard
iii) measuring instruments
iv) various electronic tools
v) connecting leads
vi) data books and catalogues

11.1.3 AMPLIFIERS

Theory

11.1.3T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) state the types of transistor configurations
b) explain the various characteristics of transistors
c) describe biasing methods of transistor
d) describe various coupling methods
e) explain different classes of amplifier operations
f) explain distortion and noise in amplifiers
g) describe the operation of operational amplifiers

Competence
The trainee should have the ability to:
i) Construct and test various amplifiers

Content

11.1.3T1 Transistor configuration
- i) common base
- ii) common emitter
- iii) common collector

11.1.3T2 Characteristics of transistors
- i) Input characteristics
- ii) Output characteristics
- iii) transfer characteristics

11.1.3T3 Biasing methods
- i) Fixed bias
- ii) Collector base bias
- iii) Potential divider bias
- iv) Emitter bias

11.1.3T4 Coupling methods
- i) R.C coupling
- ii) Transformer coupling
- iii) direct coupling
- iv) matching

11.1.3T5 Distortion and noise in amplifiers
- i) Harmonic distortion
- ii) Frequency distortion
- iii) Inter modulation distortion
- iv) Amplitude distortion
- v) Transistor noise

11.1.3T6 Classes of amplifiers
- i) Class A
- ii) Class B
- iii) Class C

iv) 11.1.3T7 Operational amplifiers
- v) definitions and terminology
- vi) Characteristics of op-amps
- vii) Applications of op-amps

Practice

11.1.3P0 Specific Objectives

By the end of the sub-module unit, the trainee should be able to:
- a) connect and operate various amplifier circuits
- b) perform various measurements and tests on an amplifier
- c) construct various amplifiers

Content

11.1.3P1 Connection and operation of amplifiers
- i) Different biasing methods
- ii) Different coupling methods
- iii) Different classes of operation

11.1.3P2 Measurements and tests
- i) Input signal levels
- ii) Output signal levels
- iii) Distortion
- iv) Bias voltage
- v) Bias current
- vi) Waveforms

vii) Power

11.1.3P3 Construction of amplifiers

Suggested Learning Resources

i) Transistors
ii) Op-amps
iii) Measuring instruments
iv) Catalogue and data books
v) Power supply units
vi) Connecting leads
vii) Electronic tool kit
viii) Training kits
ix) Bread boards

11.1.4 POWER SUPPLIES

Theory

11.1.4T0 Specific Objectives

By the end of the sub-module unit, the trainee should be able to:

a) describe the rectification processes
b) describe different methods of smoothing
c) explain the principles of power regulation and stabilization
d) explain the operation of voltage multipliers and dividers
e) explain the methods of power supply protection.

Competence

The trainee should have
The trainee should have the ability to:

i) Construct basic power supply circuits
ii) Test and measure power supply parameters

Content

11.1.4T1 Methods of power rectification
i) Half wave
ii) Full wave
iii) Methods of smoothing
iv) Full wave bridge

11.1.4T2 Smoothing
i) Reservoir capacitor
ii) R – C filter
iii) Pie filter

11.1.4T3 Regulation
i) Zener diode regulator
ii) Transistor regulator
iii) IC regulator

11.1.4T4 Voltage multipliers
i) Double
ii) Triplex
iii) quadruple

11.1.4T5 Methods of power supply protection
i) Fuses
ii) Current limiting

Practice

11.1.4P0 Specific Objectives

By the end of the sub-module unit, the trainee should be able to:

a) construct half and full wave rectifier circuits
b) construct filter network circuits
c) build simple regulator circuit
d) test and measure various supply parameters

Content

11.1.4P1 Construction of rectifier circuit
- i) Half wave
- ii) Full wave
- iii) Full wave bridge

11.1.4P2 Construction of smoothing circuits
- i) Reservoir capacitor
- ii) R – C filter
- iii) Pie filter

11.1.4P3 Construction of power supply regulators
- i) Zener diode regulator
- ii) Transistor regulator
- iii) IC regulator
- i) Construction of voltage multipliers
- ii) Double
- iii) Triplex
- iv) Quadrupler

11.1.4P4 Tests and measurements
- i) D.C .out put on no load
- ii) D.C. output on load
- iii) Load current
- iv) Ripple

Suggested Learning Resources
- i) Transformers
- ii) Rectifiers
- iii) Filters
- iv) Regulators
- v) Instruments
- vi) Charts

11.1.5 FEEBACK

Theory

11.1.5T0 Specific Objectives

By the end of the sub-module unit, the trainee should be able to:

a) explain the feedback principle
b) differentiate between positive and negative feedback
c) state types of feedback connection
d) explain the effects of feedback connections
e) state the requirements for oscillation
f) explain the operation of various oscillator circuits

Competence

The trainee should have the ability to;

i) connect and test various feedback circuits
ii) Connect and test various sinusoidal oscillator circuits

Content

11.1.5T1 Explanation of feedback principle

11.1.5T2 Positive and negative feedback
i) Gain with positive feedback
ii) Gain with negative feedback

11.1.5T 3 Effects of negative feedback on
i) Gain
ii) Stability
iii) Noise and distortion
iv) Bandwidth and response
v) Input and output resistance

11.1.5T 4 Types of feedback connections
i) Voltage shunt
ii) Voltage series
iii) Current shunt
iv) Current series

11.1.5T 5 Explanation of requirements for oscillation
i) Feedback requirement
ii) Impedance requirement

11.1.5T 6 Explanation of operation of various sinusoidal oscillation circuits
i) LC oscillators
ii) Colpit's
iii) Hartley
iv) Crystal
v) Clapps

Practice

11.1.5P0 Specific Objectives

By the end of the sub-module unit, the trainees should be able to:
a) connect and test simple negative and positive feedback circuits
b) connect and test various sinusoidal oscillator circuits

Content

11.1.5P1 Connection of positive and negative feedback circuit
i) Gain
ii) Noise
iii) Response
iv) Impendence

11.1.5P2 Connection and Testing various sinusoidal oscillator circuits
i) Frequency
ii) stability

Suggested Learning Resources
i) Manufacturers catalogue and data book

ii) Breadboard
iii) Connecting leads
iv) CRO
v) Components

11.1.6 NUMBER SYSTEMS AND CODES

11.1.6T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) translate numbers from one radix(base) to another
b) perform binary arithmetic
c) describe various coding systems
d) perform conversion of various coding systems
e) state the applications of various coding systems

Contents
11.1.6T1 Translation of one radix to another
i) Binary to decimal and vice versa
ii) Binary to octal
iii) Octal to decimal
iv) Binary to hexadecimal
v) Hexadecimal to decimal
11.1.6T2 Binary arithmetic
Addition
i) Subtraction
ii) Multiplication
iii) Division as a form of subtraction
11.1.6T3 Coding systems
i) BCD (8421)
ii) Gray code
iii) ASCII
iv) Excess - 3
11.1.6T4 Code systems conversion
i) Binary to BCD
ii) Binary to gray code and vice versa
11.1.6T5 Applications of various coding systems

Suggested Learning Resources
- Number systems charts

11.1.7 BOOLEAN ALGEBRA

Theory

11.1.7T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) state Boolean identities
b) state De Morgan's laws
c) simplify Boolean equations

Contents
11.1.7T1 Boolean identities
11.1.7T2 De Morgan's laws
11.1.7T3 Simplification using De Morgan's laws, Boolean

identities and Karnaugh map

Suggested Learning Resources

- Boolean identities charts

11.1.8 LOGIC GATES

11.1.8T0 Specific Objectives

By the end of the sub-module unit, the trainee should be able to:

a) sketch the symbols of various logic gates
b) indicate on a truth table the out put of various logic gates to given input
c) state
d) describe various logic families and their characteristics
e) state the applications of logic gates

Competence

The trainee should have the ability to:

i) Identify various logic gates
ii) Connect and test various logic gates

Contents

11.1.8T1 logic gates

i) American symbols
ii) British symbols
iii) AND
iv) OR
v) NOT
vi) NAND
vii) NOR
viii) EX OR
ix) EX- NOR

11.1.8T2 Truth table Content for various gates

11.1.8T3 Logic families and their characteristics

i) TTL (Transistor–transistor logic)
ii) DTL (Diode Transistor Logic)
iii) RTL (Resistor Transistor Logic)
iv) ECL (Emitter Coupled Logic)

11.1.8T4 Applications of logic gates

Practice

11.1.8P0 Specific Objectives

By the end of the sub-module unit, the trainee should be able to:

a) identify various logic gates
b) connect and test various logic gates

Contents

11.1.8P2 Identification of logic gates

11.1.8P1 Connection and testing of logic gates

i) Pin out identification
ii) Logic levels static tests
iii) Dynamic tests

Suggested Learning Resources

i) Digital logic trainer kit
ii) Logic gates
iii) Jumper wires
iv) DC power supply source
v) CRO

11.1.9 FLIP FLOPS

11.1.9T0 Specific Objectives

By the end of the sub module unit, the trainee should be able to:

a) define flip flops
b) describe the operation of various flip – flops

Competence

The trainee should have the ability to:

i) apply flip flops in electronic circuit
ii) test flip flop circuits

Contents

11.1.9T1 Definition of flip flops
11.1.9T2 Description of various types of flip flops
i) SR
ii) JK
iii) T
iv) D

Practice

11.1.9P0 Specific Objectives

By the end of the sub-module unit, the trainee should be able to:

a) identify various flip flops
b) carry out tests on flip flops circuits

Contents

11.1.9P1 identification of flip flops
11.1.9P2 tests on flip flop circuits

Suggested Learning Resources

i) Digital logic trainer
ii) Logic gates
iii) Jumper wire
iv) Bread board
v) DC power supply
vi) IC clips
vii) Flip flop integrated circuits

11.1.10 TRANSDUCERS

Theory

11.1.10T0 Specific Objectives

By the end of the sub-module unit, the trainee should be able to:

a) define the term transducers
b) describe the construction of various types of transducers
c) describe the operation of various types of transducers

d) state the applications of transducers

Competence

The trainee should have the ability to:

i) Identify various types of transducers
ii) Construct an test simple transducer circuits

Content

11.1.10T1 Definition of transducer

11.1.10T2 Construction of various types of transducers
i) Thermal
ii) Inductive
iii) Capacitive
iv) Photo electric
v) Acoustic

11.1.10T3 Operation of the transducers
i) Thermal
ii) Inductive
iii) Capacitive
iv) Photo electric
v) Acoustic

11.1.10T4 Application of the transducers
i) Displacement
ii) Pressure
iii) Flow rate
iv) Sound
v) Alarm systems
vi) Humidity
vii) Temperature

Practice

11.1.10P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) identify various types of transducers
b) connect simple transducer circuits

Content

11.1.10P1 Transducer circuits
i) Thermal
ii) Inductive
iii) Capacitive
iv) Photo electric
v) Acoustic

11.1.10P2 connection of transducer circuits

Suggested Assessment Methods

i) Assignment
ii) Oral tests
iii) Written tests
iv) Practical tests

11.1.11 FILTERS

Theory

11.1.11T0 Specific Objectives

By the end of the sub-module unit, the trainee should be able to:

a) describe the operation of the filter networks
b) sketch response curves of various filter net works
c) state the application of filters

Competence

The trainee should have the ability to:

- Construct and test basic filter circuits

Content

11.1.11T 1 Operation of different types of filter networks
  i) R- C filters
  ii) L – C filters
  iii) Active filters

11.1.11T 2 Response curves
  i) Low pass
  ii) High pass
  iii) Band pass

11.1.11T 3 Application of filters

Practice

11.1.11P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) construct basic filter circuits
b) test various types of filter circuits

Content

11.1.11P 1 construction of filter circuits
  i) Low pass
  ii) High pass
  iii) Band pass

11.1.11P 2 Filter circuits tests

Suggested learning resource

  i) Components (discrete, ICs)
  ii) CRO
  iii) Signal generators

12.1.0 ELECTRICAL INSTALLATIONS TECHNOLOGY I

12.1.0.1 Introduction

This module unit is designed to equip the trainee with knowledge, skills and attitude necessary to carry out electrical installation work in domestic premises and related environments.

12.1.0.2 General Objectives

By the end of the module unit, the trainee should be able to:

a) understand the operations of final circuits
b) demonstrate safety awareness when handling electrical tools and equipment
c) appreciate the correct use of tools and equipment
d) determine appropriate types of cables for a particular purpose
e) outline the distribution network in power systems
f) apply relevant principles to operate electrical machines
g) provide maintenance and service to electrical tools, equipment, cabling and accessories

12.1.0.3 Module Unit Summary and Time Allocation

Electrical Installation I

Code	Sub-Module Unit	Content	Time Hrs
12.1.1	Electrical Final Circuits	• Definition of final circuit • Description of sequence of control • Connection of lighting circuits • Ring and radial final circuits • Procedure for testing and inspection • Types of accessories and equipment • I.E.E. regulations	44
12.1.2	Electrical Power Supply	• Authorities for supply systems • Types of power supply systems	37

		• Outline of electrical power supply system	
12.1.3	Cables	• Types and sizes • Construction • Cable sizing • Factors affecting cable ratings	23
12.1.4	Protection And Earthing Of Electrical Installations	• Reason for earthing • Terminologies • Types of fuses • Earthing of an electrical installation • Earth current protection • Methods of earthing • Parts of earth • Testing for earth	33
12.1.5	Electrical Machines I	• Construction of ac machines • Construction of dc machines	33
Total Time			**170**

12.1.1 ELECTRICAL FINAL CIRCUITS

Theory

12.1.1T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) define a final circuit
b) describe the sequence of control equipment at the consumer's intake point.
c) Explain the connection of lighting circuit using joint boxes
d) explain ring and radial final circuits
e) state procedure for testing a final circuit
f) describe the different types of accessories
g) state the relevant IEE regulations

Competence

The trainee should have the ability to:

i) Interpret electrical layout diagrams for final circuits
ii) Draw wiring diagrams for final sub-circuits
iii) Install lighting circuits
iv) Install power circuits
v) Apply manipulative skills to come up with lighting circuits for various purposes
vi) performing electrical tests on an installation
vii) performing inspection a completed domestic installation
viii) Estimate materials for electrical installation work

Content

12.1.1T 1 Final Circuit

i) Definition
ii) Different type of final circuits
iii) Relevant I.E.E regulations

12.1.1T 2 Sequence of control

i) Description of equipment at intake point
ii) Consumers' equipment
iii) Power supply's equipment
iv) Correct sequence of connection
v) Relevant I.E.E regulations

12.1.1T 3 Lighting circuits

i) Loop in method
ii) Use of ceiling roses
iii) Use of joint boxes
iv) One way switching

v) Two way switching
vi) Two way and intermediate switching

12.1.1T 4 Ring and radial Power circuit
i) Socket outlet (3A)
ii) Protective devices
iii) Relevant I.E.E regulations requirements
iv) Water heater circuits
v) Instantaneous water heater
vi) Non instantaneous water heater
vii) Astern type water heater
viii) Relevant I.E.E regulations requirements

12.1.1T 5 Testing and inspection
i) Visual inspection
ii) Verification of polarity
iii) Earthing tests
iv) Insulation resistance test
v) Continuity of ring continuity test
vi) I.E.E regulations for tests and inspection of an electrical installation

12.1.1T 6 Accessories and equipment
i) Definition
ii) Accessory
iii) switch plug
iv) Socket outlet
v) joint box
vi) distribution board
vii) Types of accessories for lighting circuits
viii) Switches
ix) Lamp holders
x) Ceiling roses
xi) joint boxes
xii) (relevant I.E.E regulations)
xiii) Clock connections
xiv) Electric shaver sockets

12.1.1T 7 Relevant I.E.E. regulations
i) Other types of accessories
ii) Consumers control unit
iii) Distribution board
iv) Observe the relevant IEE regulations

Practice

12.1.1P0 Specific Objectives
By the end of the sub-module unit, the trainee should be able to:
a) interpret electrical drawings and complete install lighting final circuits
b) install ring and radial final circuits
c) inspect and test final circuits

d) state the relevant IEE regulations in each case
e) observe safety, standards and good workmanship while performing electrical installation work.
f) estimate material requirements for an installation work
g) carry out quality control checks

Content

12.1.1P1 Interpretation of electrical drawings
- i) Symbols
- ii) Dimensions and tolerance
- iii) Lay out
- iv) Special conditions

12.1.1P2 Installation of ring and radial final circuits
- i) Taking measurements
- ii) Level, tight and neat fixing of components

12.1.1 P3 Inspection and tests of final circuits

12.1.1P4 Testing and inspection
- i) Visual inspection
- ii) Testing procedures for all the tests
- iii) Verification of polarity
- iv) Earthing tests
- v) Insulation resistance test
- vi) Continuity of ring continuity test
- vii) Expected readings

12.1.1P5 I.E.E regulations for tests and inspection of an electrical installation

12.1.1P6 Safety observation in electrical work
- i) Safety of self
- ii) Safety of others
- iii) Safety of tools and equipment

12.1.1P7 Material estimate
- i) Measured items
- ii) Numbered items
- iii) Fixes

12.1.1P8 Quality control checks
- i) Correct usage of tools and measuring instruments
- ii) Good quality finish and appearance
- iii) Correct measurements and accuracy
- iv) Application of set test procedures and
- v) Performance as per specifications of the design

Suggested teaching and learning resources
- i) Electrical tool kit
- ii) PVC conduits
- iii) PVC sheathed cable
- iv) PVC mini-trunking
- v) Various cable sizes

vi) Vertical wooden boards, masonry walls
vii) Ohmmeter
viii) Test lamp
ix) Multi-tester for continuity and insulation resistance tests

12.1.2 ELECTRICAL POWER SUPPLY

12.1.2T0 Specific Objectives

By the end of the sub-module unit, the trainee should be able to:

a) explain the main work of the authorities for power production in Kenya
b) describe various types of power supply systems
c) describe the outline of the various power transmission and distribution systems from generation to the consumer
d) describe different transmission and distribution systems
e) compare A.C. and D.C. systems of transmission

Competence

The trainee should have the ability to select and carry out installation for a typical distribution system for a small plant

Contents

12.1.2T1 Authorities of power production
- i) Kenya Power and Lighting Company (KP.L.C)
- ii) Ken Gen
- iii) Independent power producer
- iv) The electricity board
- v) The development authorities

12.1.2T2 Power supply systems
- i) Typical layout diagrams
- ii) Types of generating stations
- iii) Transmission stage
- iv) Distribution stage

12.1.2T3 Transmission and distribution systems
- i) D.C two wire
- ii) D.C three wire
- iii) A.C two wire
- iv) A.C. four wire
- v) Radial and ring distribution

12.1.2T4 AC and DC systems
- i) Advantages of each
- ii) Disadvantages of each

12.1.2T5 AC and DC power systems

Practice

12.1.2P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) select and carry out installation for a typical distribution system for small industrial plant
b) observe the IEEE regulations on transmission and distribution

Content

12.1.2P1 Electrical installation
- 3 phase, 4 wire distribution system with single phase loads

12.1.2P2 Safety observation
i) Personal safety
ii) Safety for others

Suggested teaching and learning resources

i) 3 phase distribution board
ii) Consumer control units
iii) Planned industrial visit

12.1.3 CABLES

Theory

12.1.3T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:

a) state types and sizes of cables
b) describe the construction of cables
c) calculate the correct size of cable for a given load using appropriate tables and rating factors
d) explain the factors affecting cable ratings
e) explain the methods of joining metals and their applications

Contents

12.1.3T1 Types and sizes of cables
i) Types of conductors
ii) Copper
iii) Copper properties
iv) Aluminum
v) Aluminum properties
vi) Cable sizes
vii) Determine the size of a cable given the strand diameter
viii) Applications of cable types

12.1.3T2 Construction
i) Armoured
ii) Non-armoured
iii) Purposes of stranding

12.1.3T3 Cable size calculations
- Cable ratings

12.1.3T4 Factors affecting cable rating

12.1.3T45 Cable joints and terminations
- i) Cable joints
- ii) Soldering twisted tee joints using blow lamp
- iii) Soldering joints using pot and ladle
- iv) Cable terminations
- v) Clamping method
- vi) Crimping method
- vii) Regulations regarding joints
- viii) Dangers of poor joints
- ix) dry joint
- x) high resistance in joints

Practice

12.1.3P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
- a) make various cable joints such that they are electrically and mechanically sound
- b) solder the joints effectively
- c) perform cable terminations
- d) perform tests on cable joints

Content

12.1.3P1 Performance of cable joints

12.1.3P2 Soldering procedure
- i) Soldering by use of pot and ladle
- ii) Soldering by use of electric soldering iron
- iii) Soldering by use of blow lamp

12.1.3P3 Cable terminations
- IEE regulations on cable joints

12.1.3P4 Tests on cable joints

Suggested Learning Resources
- i) Chalkboard
- ii) Books
- iii) Various types of cables
- iv) I.E.E regulations table for cable data
- v) Pot and ladle
- vi) Soldering gun
- vii) Crimping tool

12.1.4T0 PROTECTION AND EARTHING OF ELECTRICAL INSTALLATIONS

Theory

12.1.4T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
- a) explain the reason for earthing
- b) define various terminologies used in earthing and protection of electrical installations

c) describe the different types of fuses
d) define terms applied to earthing of an installation
e) explain the different methods of earth current protection
f) explain the different methods of earthing
g) explain parts of an earthing system
h) describe the tests for an earthing system

Competence

The trainee should have the ability to:

i) Select and use circuit protection
ii) Earth a domestic installation
iii) Test the operation of various protective devices
iv) Perform earth loop impedance tests

Content

12.1.4T1 Reasons for earthing

12.1.4T12 Definition of terms

i) Over current
ii) Short circuit
iii) Earth leakage
iv) Close excess current protection
v) Coarse excess current protection
vi) Discrimination
vii) Fusing factor
viii) Fusing current

12.1.4T3 Types of fuses

i) Rewirable fuses
ii) Cartridge fuses
iii) High rupturing capacity fuses
iv) Construction and operation of various types of fuses
v) Application of various fuses

12.1.4T4 Earthing terminologies

i) Earth
ii) Earthed
iii) Solidly earthed
iv) Earth electrode
v) Earthing lead
vi) Earth continuity conductor
vii) Live metal work
viii) Protective Multiple Earthing (PME)
ix) Earth resistivity
x) Earth resistance

12.1.4T5 Methods of earth currents protection

i) Fuses
ii) Circuit breakers
iii) operation of excess current and earth leakage protection devices

12.1.4T6 Methods of earthing

i) Connection of metal work to the supply earth conductor
ii) Continuous Earth Wire (CEW)

iii) The earth electrode
iv) Protective Multiple Earthing (PME)
v) Automatic fault protection
vi) Miniature circuit breakers
vii) Current operated earth leakage circuit breaker
viii) Voltage operated earth leakage circuit breaker

12.1.4T7 Parts of an earthing system
i) Earth Continuity Conductor (E.C.C)
ii) Earthing lead
iii) Earth electrode

12.1.4T8 Tests
i) Earth continuity
ii) Earth loop impendence
iii) Earth loop resistance

Practice

12.1.4P0 Specific Objectives
By the end of the sub-module unit, the trainee should be able to:
a) perform earthing of domestic installation
b) install residual current circuit breakers
c) measure earth loop impendence
d) measure of earth resistance area
e) carry out various earthing tests

Contents

12.1.4P1 Protection of domestic installations

12.1.4P2 Installation of residual current circuit breaker
i) Tests on the circuit breaker
ii) Installation of the circuit breaker

12.1.4P3 Measurement of earth loop impendence
i) Determination of the loop
ii) Identification of the test instrument

Suggested teaching and learning resources
i) High Breaking Capacity(HBC) fuse
ii) Cartridge fuse
iii) Miniature Circuit Breaker
iv) Consumer control unit
v) Distribution board
vi) Rewireable fuses
vii) Earthing rods
viii) Earth continuity conductor
ix) Residue current devices
x) Voltage operated Earth Leakage Circuit Breaker (E.L.C.B)

xi) Institutes installation network
xii) Insulation and continuity tester
xiii) Earth resistance and Neutral Earth loop impendence tester

12.1.5 ELECTRICAL MACHINES I

Theory

12.1.5 T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) draw and label the constructional parts of ac machines
b) draw and label the constructional parts of dc machines

Competence
The trainee should have the ability to:
i) Dismantle a.c. and d.c. motors
ii) Assemble a.c. and d.c. motors
iii) Inspect a.c. and d.c. motors
iv) Test a.c. and d.c. motors
v) Carry out quality control checks

Content

12.1.5 T1 Constructional parts of different types of ac machines
i) Single – phase motors
ii) Split – phase motor
iii) Capacitor start motor
iv) Capacitor start and run motor
v) Capacitor start, capacitor run motor
vi) Shaded – pole motor

12.1.5 T2 Constructional parts of dc motors
i) Series motor
ii) Shunt motor
iii) Compound motor
iv) Universal motor

Practice

12.1.5 P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) dismantle single phase motors
b) assemble single phase motors
c) dismantle direct current motors
d) assemble direct current motors
e) inspect single phase and D.C motors for
f) proper operation
g) Carry out control checks at every stage

Content

12.1.5 P1 Dismantling of single phase motors
- i) Single – phase motors
- ii) Split – phase motor
- iii) Capacitor start motor
- iv) Capacitor start and run motor
- v) Capacitor start, capacitor run motor
- vi) Shaded – pole motor

12.1.5 P1 Assembly of single phase motors
- i) Single – phase motors
- ii) Split – phase motor
- iii) Capacitor start motor
- iv) Capacitor start and run motor
- v) Capacitor start, capacitor run motor
- vi) Shaded – pole motor

12.1.5 P1 Dismantling of direct current motors

12.1.5 P1 Assembly of direct current motors
- i) Series motor
- ii) Shunt motor
- iii) Compound motor
- iv) Universal motor
- v) Inspection of single phase motors and d.c. motors for proper operations

Suggested Learning Resources
- i) Single phase motors
- ii) dc motors
- iii) Tools including
- iv) Markers
- v) Field visits

13.1.0 SOLAR INSTALLATION SYSTEMS

13.1.01 Introduction

The solar system module unit is designed to equip the trainee with knowledge skills and attitudes necessary to understand and install solar installation systems.

Trainees will appreciate prior knowledge and skills acquired in Electrical Installation I of this course.

13.1.02 General Objectives

By the end of module unit, the trainee should be able to:

a) understand the basic principles of solar systems
b) acquire relevant skills for installation solar systems
c) create awareness in the application of solar systems
d) interpret solar system data to determine the solar sizes
e) observe safety rules and standards when installing solar system panels
f) institute quality control measures while installing solar systems
g) prepare, maintenance schedules and maintain solar systems

13.1.03 Module Unit Summary and Time Allocation

Solar Installation Systems

Code	Sub-Module Unit	Sub Sub-Module Unit	Time Hrs
13.1.1	Solar Installation Systems Fundamentals	• Solar energy and its conversion • Terms used with solar systems • Methods of solar energy harvesting • Applications	10
13.1.2	Solar (Photo Voltaic) System	• Parts of a photovoltaic • Functions of each part of a voltaic system • layout of the photo voltaic system	8
13.1.3	Solar Systems' Accessories	• Types of accessories • Types of cable joints	10

		• Wiring systems • Choice of wiring systems • Tests performed on completed installation • Regulations governing solar installations	
13.1.4	Maintenance And Servicing Of Solar Systems	• Procedure for maintenance • Repair and trouble shooting	4
13.1.5	Solar System Sizing	• Terminologies • Sizing a solar system • Daily load energy demand • Equipment, cables and accessories sizing • Application of solar data	12
Total Time			**44**

13.1.1 SOLAR SYSTEMS BASICS

Theory

13.1.1T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) explain solar energy and its conversion
b) define various terms used with solar energy
c) state various methods of solar energy harvesting
d) list applications of solar energy

Competence

The trainee should have the ability to:

i) Identify various forms of solar energy
ii) Harvest solar energy
iii) Utilize solar energy in various forms

Content

13.1.1T1 Solar energy and its conversion:

i) Sun as a source of energy
ii) Conversion of solar to chemical energy (photosynthesis)
iii) Solar to heat (thermal)
iv) Solar to electricity
v) Solar to biomass

13.1.1T3 Definition of terminologies:

i) Radiation
ii) Direct and indirect radiation
iii) Insolation

13.1.1T4 Methods of solar energy harvesting:

i) Solar module (solar cells)
ii) Parabolic reflectors
iii) Dish reflectors
iv) Box reflectors
v) Flat plate collectors (water heating)

13.1.1T5 Applications of solar energy:

i) Crop drying
ii) Cooking
iii) Water heating
iv)Electricity
v) Space heating
vi)Green houses

Practice

13.1.1P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) perform solar energy harvesting using various methods
b) apply solar energy in day – to – day life

Content

13.1.1P1 Solar energy harvesting:

i) Solar module (solar cells)
ii) Parabolic reflectors
iii) Dish reflectors
iv) Box reflectors
v) Flat plate collectors (water heating)

13.1.1P2 Applications of solar energy:
i) Crop drying
ii) Cooking
iii) Water heating
iv) Electricity
v) Space heating
vi) Green houses

Suggested Learning Resources
i) Solar energy equipment and apparatus
ii) Solar module (solar cells)
iii) Parabolic reflectors
iv) Dish reflectors
v) Box reflectors
vi) Flat plate collectors (water heating)
vii) Charts for solar installations
viii) Field visits to solar homes

13.1.2 SOLAR INSTALLATION SYSTEMS

Theory

13.1.2T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:
a) list the various parts of a photovoltaic systems
b) explain the functions of each part of a voltaic system
c) illustrate the layout of a photo voltaic system

Competence
The trainee should have the ability to:
a) identify the various parts of a photo voltaic system
b) read and interpret solar system drawings
c) install solar systems

Content
13.1.2T1 Parts of a photovoltaic system.
i) Module array
ii) Charge controller
iii) Battery
iv) Inverter
v) Wires and accessories
vi) Loads

13.1.2T2 Functions of parts of Photo Voltaic Systems
i) Charge controller
ii) Battery
iii) Inverter
iv) Wires and accessories

v) Loads

13.1.2T3 Solar system lay out
i) Block diagram
ii) Schematic diagrams.

Practice

13.1.2P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) Identify various components of a photo voltaic systems
b) Read and interpret a solar system layout.
c) Install a photo voltaic (solar system) using the right tools.

Content

13.1.2P1 Components of a photo voltaic system
i) Module array
ii) Charge controller
iii) Battery
iv) Inverter
v) Wires and accessories
vi) Loads

13.1.2P2 Solar system lay out
i) Block diagram
ii) Schematic diagrams.

13.1.2P3 Installation of a solar system

Suggested Learning Resources
i) Solar module
ii) Charge controllers
iii) Inverter
iv) Lead- acid cells
v) Solar batteries
vi) Various accessories and wires
vii) Manila papers (Charts)
viii) Tools
ix) Solar system service kit

13.1.3 SOLAR SYSTEMS' ACCESSORIES

Theory

13.1.3T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) describe various types of accessories.
b) describe various types of cable joints
c) list various types of wiring systems for a solar systems
d) explain factors that are considered when choosing a wiring system
e) outline the tests, in the right procedures on a complete installation
f) apply various electrical regulations governing solar installations.

Competence

The trainee should have the ability to:

i) identify the accessories for a photo voltaic system
ii) perform cable joints
iii) install electrical circuit using various types of wiring systems
iv) test solar electrical systems in the right sequence
v) apply electrical regulations and standards in the photo voltaic installation work

Content

13.1.3T1 Types of accessories
i) Ac and dc switches
ii) Socket outlets
iii) Lamp holders
iv) Ceiling roses
v) Patresses
vi) Consumer control units
vii) Consumer control units

13.1.3T2 Types of cable joints
i) Telegraphic joint
ii) T Joint Married joint
iii) Bell hangers joint

13.1.3T3 Wiring systems for P.V systems
i) sheathed wiring systems
ii) Tough rubber sheath,
iii) polyvinyl chloride(PVC) sheath,
iv) polychloroprene (PCP)

13.1.3T4 Factors that are considered when choosing a wiring system
i) Cost
ii) Durability
iii) Safety
iv) Aesthetics
v) Nature of building

13.1.3T5 Tests procedures for an installation:
i) Physical inspection
ii) Electrical tests
iii) Ring continuity tests
iv) Effectiveness of the earth tests
v) Insulation tests
vi) Polarity tests

13.1.3T6 Electrical regulations governing solar installations

Practice

13.1.3P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) make various types of cable joints and terminations
b) select suitable wring systems and install P.V systems

c) perform in the right procedure, tests in a complete solar installation
d) carry out quality control checks

Content

13.1.3P1 make of cable joints and terminations
- i) joints
- ii) Telegraph
- iii) Scarf
- iv) Britannia
- v) Bell hanger's
- vi) T Joint
- vii) Married
- viii) Terminations
- ix) Loop
- x) Claw
- xi) Spade
- xii) Crimped
- xiii) Lug
- xiv) crimping

13.1.3P2 Wiring systems for solar systems
- i) sheathed wiring systems
- ii) tough rubber sheath
- iii) polyvinyl chloride(PVC) sheath
- iv) polychloroprene (PCP)
- v) regulations and standards for P.V installations
- vi) conduit wiring systems for P.V systems
- vii) PVC conduit wiring systems

13.1.3P3 Tests procedures for an installation
- i) Physical inspection
- ii) Electrical tests
- iii) Polarity
- iv) Earthing
- v) Insulation
- vi) Ring continuity

13.1.3P4 Electrical regulations governing solar installations

13.1.3P5 Quality control checks for solar systems installations
- i) Material selection
- ii) Selection of tools and equipment
- iii) Measuring, marking out and fixing of components and equipment and application of acceptable tolerance
- iv) Termination techniques
- v) Testing of the completed installation
- vi) Compliance with the set standards
- vii) Good quality finish and appearance

Suggested Learning Resources
- vi) Assorted accessories
- vii) Chalk board
- viii) Text books

ix) Instruments
x) Resource persons
xi) Manuals

13.1.4 MAINTENANCE AND SERVICING OF SOLAR SYSTEMS

Theory

13.1.4T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) explain the procedures for solar system maintenance
b) outline trouble shooting and repair procedures of a solar system.

Competence
The trainee should have the ability to:
i) install a photo voltaic system
ii) test a photo voltaic system
iii) service and maintain photo voltaic system

Content
13.1.4T1 Solar system maintenance procedure,
i) Battery maintenance
ii) cleaning,
iii) topping up electrolyte level,
iv) checking the state of charge,
v) equalizing charge
vi) Module maintenance:
vii) dusting and testing modules
viii) Checking of connections
ix) System records and manuals

13.1.4T1 Trouble shooting procedures:
i) Module condition
ii) Battery condition
iii) Control and Protection devices
iv) Lamp conditions

Practice

13.1.4P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) test a solar system for proper operation
b) service and maintain a solar system for proper operation

Content
13.1.4P1 Testing a solar system for proper operation
i) Checking / testing the outputs of a module – Voltage, current and power
ii) Checking parameters of a charge controller

iii) Checking for loose connections

13.1.4P2 Servicing and maintaining a solar system
- i) Battery –
- ii) topping up
- iii) electrolyte level
- iv) charge level
- v) Module cleaning.
- vi) Checking for loose connections
- vii) Checking all other connections,
- viii) charge controller,
- ix) inverter,
- x) loads
- xi) Checking for burnt out lamps and replacing the same
- xii) Applying current electrical regulations and codes of practice in all areas of tests and inspection

Suggested Learning Resources
- i) Solar system tool kit
- ii) Solar Battery
- iii) Solar Module
- iv) Solar energy inverter
- v) Solar system service kit.

13.1.5 SOLAR SYSTEM SIZING

Theory

13.1.5T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
- a) explain terminologies used with solar systems.
- b) explain the need for sizing a solar system
- c) determine the daily load energy demand for any system specifications
- d) determining the right size of equipment, cables and accessories
- e) size a typical solar system given all the necessary data.

Competence
The trainee should have the ability to:
- i) Identify the right wires, accessories, cables and apparatus for a solar system.

Content

13.1.5T1 Terminologies for solar system technology
- i) Module outputs and specifications
- ii) Daily energy requirement
- iii) Number of battery storage days
- iv) Battery capacity

v) Depth of discharge/depth of charge
vi) Insolation
vii) tracking

13.1.5T2 Need for sizing
i) Need for the right size of the module
ii) Need for the right charge controller
iii) Need for the battery
iv) Need for the right size of fuse and circuit breaker

13.1.5T3 Determination of daily energy demand as
i) Energy due to lamps
ii) Energy due to other loads
iii) Power required to cater for the losses
iv) Total daily energy demand

13.1.5T4 Determining the right size of equipment:
i) Module
ii) Cables and accessories factors to consider:
iii) Charge controller – Factors to consider:
iv) Inverter factors to consider
v) Battery.

13.1.5T5 Step – by – step sizing of solar systems
vi) Total daily energy demand
vii) Systems voltage
viii) Systems current hours
ix) Insolation effect
x) Autonomy effect
xi) Tracking effect
xii) Choice of modules, battery charge controllers inverters
xiii) Choice of cables and accessories.

Practice

13.1.5P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to size typical solar system.

Content

13.1.5P0 Needs of an installations
i) Need for sizing
ii) Daily energy demand

Suggested teaching and learning resources
i) Drawing board
ii) Calculator
iii) Catalogues
iv) Data for solar equipment

CRAFT CERTIFICATE IN ELECTRICAL AND ELECTRONIC TECHNOLOGY

TELECOMMUNICATION OPTION

MODULE II

MODULE II

MODULE II

INTRODUCTION

The module is designed for trainees who have successfully completed module I of craft certificate in electrical and electronic technology course or its equivalent.

It is intended to impart knowledge skills and attitudes that will meet the needs of electrical and electronic technology industry for technician assistants who will install repair and service telecommunications installations, equipment and devices.

Upon successful completion of this module, trainee will have acquired knowledge and skills in radio systems, data communication and electrical and electronic instruments.

GENERAL OBJECTIVES

At the end of the module, the trainee should;

a) Understand the principles of operation of information and data communication equipment and devices
b) Inculcate the culture of maintenance in telecommunication systems
c) Write a proposal for a planned trade project for a small micro-enterprise
d) Appreciate the need for quality work in production and services delivery
e) Observe safety rules and regulations in the work place
f) Understand and deal with challenges posed by their psychological, social and economic circumstances
g) Adapt to emerging trends in the Telecommunication industry.

KEY COMPETENCE

By the end of the module the trainee should be able to demonstrate the following Competence;

The trainee should have the ability to:

i) Wire and service electrical machine controls
ii) Install, repair and maintain electrical installations for extra low, low and medium voltages
iii) Design an electrical installation for extra low, low and medium voltages
iv) Diagnose and repair faults in electrical installations, machines and equipment
v) Estimate materials and cost electrical installations work.

The units in this module are:

14.2.0 Life Skills
15.2.0 Electrical Principles II
16.2.0 Communication Skills
17.2.0 Workshop Organisation and Management
18.2.0 Mathematics II
19.2.0 Micro Electronics
20.2.0 Radio Systems
21.2.0 Television Fundamentals
22.2.0 Data Communication
23.2.0 Instruments and Electronic Fault Diagnosis
24.2.0 Business Plan
25.2.0 Trade Project

14.2.0 LIFE SKILLS

14.2.01 INTRODUCTION TO LIFE SKILLS

This module unit is intended to equip the trainee with knowledge, skills, attitudes and values that empower him/her to face challenges posed by their physiological, psychological, social and economic circumstances. It will enable them to take responsibility for their individual actions.

14.2.02 GENERAL OBJECTIVES

By the end of the module unit, the trainee should be able to:

a) develop an awareness and understanding of every day demands and challenges through critical thinking
b) understand and deal with their health problems, fears and anxieties about growing up, sexuality and relationships
c) enhance self-esteem and assertiveness in their relationships with peers and adults
d) develop an appreciation of females and males as equal partners in society
e) make optimum use of time and available resources in order to improve the quality of life
f) develop attitudes, values and skills that promote co-existence, positive, responsible and healthy life styles
g) develop an understanding support and a sense of care and responsibility for disadvantaged groups in the community

14.2.03 MODULE UNIT SUMMARY AND TIME ALLOCATION

LIFE SKILLS

Code	Sub module unit	Content	Time hrs
14.2.1	Introduction to Life skills	• Define the term life skills • Categories • Benefits • Living values and our lives • Relationship between life skills and living values	2

14.2.2	Knowing and Living With Oneself: - Self Awareness	• Self description • Self assessment • Challenges that hinder the attainment of life goals • Strategies of overcoming challenges • Values associated with self awareness skill	4
14.2.3	Self Esteem	• Definition of self esteem • Signs of high and low self esteem in an individual • Signs of low self esteem • Effects of low self esteem • Factors that enhance high and low esteem • Importance of high self esteem • Values associated with high self esteem • How to boost self esteem	2
14.2.4	Stress Management	• Definition of emotion • Definition of stress • Causes of stress • Effects of stress • Coping with stress • Forms of positive stress • Values associated to positive stress management	2
14.2.5	Coping With Emotion	• Definition of emotion • Good and bad feelings • Causes of good and bad feelings • Meaning of emotional intelligence • Feelings which can lead to risky behaviour • Ways of coping with negative emotions • Values associated with emotional intelligence	2

14.2.6	Empathy	• Definition of empathy • Importance • Difference between empathy and sympathy • Situations requiring empathy • Values associated with empathy	4
14.2.7	Assertiveness	• Definition of assertiveness • Characteristics of an assertive person • Steps to being assertive • Difference between assertiveness and aggression • Difference between peer pressure and influence • Values associated with assertiveness	4
14.2.8	Negotiation	• Definition of negotiation • Importance • Situations that require negotiating • Negotiating techniques • Values associated with negotiations	4
14.2.9	Non-Violent Conflict Resolution	• Definition of conflict • Causes of conflict • Consequences • Types of conflict • Ways of dealing with conflict • Skills for conflict management • Institutions that resolve conflict in community • Values related to conflict resolution	2
14.2.10	Effective Decision Making	• Situations that require decision making • Challenges facing youth in decision making • Factors influencing decisions making	4

		• Steps to effective decision making • Consequences • Decision making institutions within community • Steps to effective decision making • Values associated with effective decision making	
14.2.11	Critical Thinking	• Meaning of critical thinking • Risky situations • Evaluating ideas or issues objectively • Consequences of making decisions before critical thinking • Values associated with critical thinking	4
14.2.12	Creative Thinking	• Definition • Situations that require creative thinking • Importance • Consequences • Associated values	4
14.2.13	Problem Solving	• Problem areas • Causes of problems • Tools • Problem solving process • Values necessary for solving problems	3
14.2.14	Leisure	• Definition of leisure • Effects of misuse of leisure • Activities for positive leisure • Life skills for positive use of leisure • Values	3
14.2.15	Time Management	• Definition • Work schedule • Time management chart • Importance	2

		• Time robbers • Values and associated life skills	
14.2.16	Gender Education	• Definition • Agents perpetuating gender • Gender stereotyping • Effects of gender • Strategies to eliminate gender discrimination • Associated values	2
14.2.17	Drug and Substance Abuse	• Definition of terms • Commonly abused drugs • Causes • Symptoms • Effects • Relationship between drug abuse and HIV and AIDS • Prevention • Management • Life skills and values necessary	4
14.2.18	HIV and AIDS	• Definition of terms • Transmission • Signs and symptoms • Catalysts • Prevention • Interventions • Misconceptions • Care and support	3
14.2.19	Child Labour	• Definition of terms • Difference between child labour and work • Forms of child labour • Factors leading to child labour • Awareness on child labour • Interventions • Appropriate life skills	4
14.2.20	Child Rights	• Definition of terms • Types of human needs	3

		• UN Conventions • Categories of child rights • Importance of child rights • Responsibilities • Principles in right of child • Life skills and values	
14.2.21	Relationships	• Types of relationships • Developing healthy relationships • Factors that influence healthy relationships • Maintaining healthy relationships • Influence of relationships on behaviour • Values associated with relationship • Life skills	4
Total Time			**66**

14.2.1 INTRODUCTION TO LIFE SKILLS

Theory

14.2.1T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:

a) define the term life skills
b) outline the categories of life skills
c) explain the benefits of life skills education to the society
d) explain living values and how they relate to our lives
e) explain the relationship between life skills and living values.

Content

14.2.1 T1 Definition of term life skills

14.2.1 T2 Categories of life skills
i) Skills of knowing and living with oneself
ii) Skills of knowing and living with others
iii) Skills of making effective decisions

14.2.1 T3 Benefits of life skills education to the society in the following sectors
i) Education
ii) Social
iii) Health.

14.2.1T4 Living values and our lives

14.2.1 T5 Relationship between life skills and living values

Suggested Teaching/Learning Activities

- Discussions
- Note taking

Suggested Teaching/Learning Resources

- Life skills manuals
- Charts
- Journals and magazine feature articles

Suggested Evaluation Methods

- Continuous assessment tests
- Timed written tests

14.2.2 KNOWING AND LIVING WITH ONESELF: SELF AWARENESS

Theory

14.2.2T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:

a) outline ways of describing him/herself
b) outline ways of assessing themselves

Content

14.2.2T1 Self Description
i) Who Am I?
ii) Physical attributes
iii) Life vision and mission
iv) Personal values, beliefs, goals and ambitions.

14.2.2T2 Self Assessment
i) Strengths and weaknesses

14.2.2T3 Challenges that Hinder the Attainment of Life Goals

14.2.2T4 Strategies of Overcoming Challenges

14.2.2T5 Values Associated With the Self Awareness Skill

Practice

14.2.2P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
draft a self analysis table beliefs, goals and ambitions
draft a life vision and mission

Content

14.2.2P1 Drafting of a self analysis table describing personal values, beliefs, goals and ambitions

14.2.2P2 Drafting of a life vision and mission

Suggested Teaching/Learning Activities
- Discussions
- Note taking

Suggested Teaching/Learning Resources
- Life skills manuals
- Charts
- Journals and magazine feature articles

Suggested Evaluation Methods
- Continuous assessment tests
- Timed written tests

14.2.3 SELF ESTEEM

Theory

14.2.3T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) define the term self esteem
b) outline signs of high self esteem in an individual
c) outline signs of low self esteem in an individual

d) explain factors that enhance high and low self esteem
e) state the importance of having high self esteem
f) describe the effects of low self esteem
g) highlight values associated with high self esteem
h) explain ways of boosting self esteem.

Competence

The trainee should have the ability to:

i) Have a feeling of self worth
ii) Relate well with others
iii) Be confident
iv) Have positive self pride
v) Feel good about oneself

Content

14.2.3T1 Definition of self esteem

14.2.3T2 Signs of high self esteem

i) self confidence
ii) self discipline
iii) relating well with others
iv) self care

14.2.3T3 Signs of low esteem

i) isolation
ii) self doubt
iii) self neglect
iv) vulnerability
v) aggressiveness
vi) low performance of tasks

14.2.3T4 Effects of low self esteem

i) unhappiness
ii) vulnerability to HIV infection
iii) drug abuse
iv) physical and emotional abuse

14.2.3T5 Factors that enhance high self esteem

i) good health habitsgoal setting
ii) good grooming

14.2.3T6 Importance of high self esteem

14.2.3T7 Values associated with high self esteem

i) humility
ii) self respect
iii) happiness

14.2.3T8 Ways of boosting self esteem

i) Praise/acknowledging effort

Practice

14.2.3P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) express feelings of self hate and self acceptance in group or one-on-one counselling session
b) demonstrate self pride and confidence.

Content

14.2.3P1 Expressing one's feelings of self hate and self acceptance in group or one-on-ne counselling session

14.2.3P2 Role play a situation of self pride and confidence

S*uggested Teaching/Learning Activities*

- Discussions
- Note taking

Suggested Teaching/Learning Resources

- Guest speaker
- Charts
- Journals and magazine feature articles
- Educational audio-visual media

Suggested Evaluation Methods

- Continuous assessment tests
- Timed written tests

14.2.4 STRESS MANAGEMENT

Theory

14.2.4T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) define stress
b) describe situations that lead to stress
c) discuss effects of stress
d) suggest ways of coping with stress
e) identify forms of positive stress
f) give values associated to positive stress management.

Competence

The trainee should have the ability to:

i) Identify stressors
ii) Avoid stressors
iii) Manage stress

Content

14.2.4T1 Definition of stress

14.2.4T2 Causes of stress

i) growth and development (biological,

physical and mental)
ii) peer pressure
iii) communication within families
iv) need to belong
v) lack of positive time management
vi) Displacement
vii) Conflicts

14.2.4T3 Effects of stress
i) displacement
ii) aggression
iii) social maladjustment
iv) drug and substance abuse
v) immorality
vi) diseases such as HIV and Aids
vii) Post traumatic stress disorders

14.2.4T4 Coping with stress
i) organize work in order of priority/work within possible working schedules
ii) take a break/relax/exercise
iii) share feelings with others

14.2.4T5 Forms of positive stress

14.2.4T6 Values associated to positive stress management
i) peace
ii) tolerance
iii) co-operation
iv) unity
v) avoid stressors
vi) cope / manage stress
vii) apply values to manage stress

Practice

14.2.4P 0 *Specific Objective*

By the end of the sub-module unit, the trainee should be able to identify positive ways of stress management.

Content

14.2.4P1 Role Play a stressful situation and identify positive ways of stress management

14.2.6 COPING WITH EMOTIONS

Theory

14.2.6T0 *Specific Objectives*

By the end of this sub module unit, the trainee should be able to:
a) define the term 'emotion'
b) identify good and bad feelings
c) explain causes of each feeling

d) explain the meaning of emotional intelligence
e) discuss feelings which can lead to risky behaviour
f) suggest ways of coping with emotions
g) state values associated with emotional intelligence

Competence

The trainee should have the ability to:
i) be calm
ii) be patient
iii) take time before acting.

Content

14.2.6T1 Definition of the term 'emotion'
14.2.6T2 Good and bad feelings
14.2.6T3 Causes of good/bad feelings
14.2.6T4 Feelings which can lead to risky behaviour
i) bitterness
ii) sadness
iii) excitement
iv) hurt
14.2.6T5 Meaning of emotional intelligence
14.2.6T6 How to control negative emotions
i) talk to somebody
ii) take a break/sleep/rest /walk
iii) do exercises
14.2.6T7 Values associated with emotional intelligence
i) peace
ii) humility
iii) tolerance
iv) respect

Practice

14.2.6P0 *Specific Objective*
By the end of the sub-module unit, the trainee should be able to identify different kinds of emotions

Content

14.2.6P1 Identification of different kinds of emotions from photographs and video clips

14.2.8 EMPATHY

Theory

14.2.8T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) define empathy
b) explain the importance of empathizing
c) explain the difference between empathy and sympathy
d) explain situations that require empathy
e) outline values associated with empathy.

Competence

The trainee should have the ability to:
i) Empathise with people in need
ii) Demonstrate positive values in situations that require empathy.

Content

14.2.8T1 Definition of empathy

14.2.8T2 Importance of empathizing e.g. in times of
i) death
ii) HIV/AIDS infected or affected
iii) joblessness
iv) sickness

14.2.8T3 Difference between empathy and sympathy

14.2.8T4 Values associated with empathy
i) responsibility
ii) respect
iii) love
iv) kindness
v) co-operation
vi) tolerance

Practice

14.2.8P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to differentiate empathy from sympathy.

Content

14.2.8P1 Role Play situation and differentiate empathy form sympathy

14.2.9 ASSERTIVENESS

Theory

14.2.9T0 Specific Objectives
By the end of the sub-module unit, the trainee should be able to:

a) define assertiveness
b) explain characteristics of assertive behaviour
c) describe steps to being assertive
d) explain the importance of being assertive
e) differentiate being assertiveness from being aggressive and passive
f) explain the difference between peer pressure and peer influence
g) outline values associated with assertiveness.

Competence

The trainee should have the ability to:
i) Be firm without being influenced by others
ii) Say NO to negative influence or YES to positive behaviour

Content

14.2.9T1 Definition of assertiveness
14.2.9T2 Identify characteristics of an assertive person
14.2.9T3 Steps to being assertive
14.2.9T4 Importance of being assertive
  i) achieving ones goals
  ii) avoiding getting into trouble
14.2.9T5 Differentiate between aggressiveness and passiveness
14.2.9T6 Differentiate peer pressure from peer influence
14.2.9T7 Values associated with assertiveness
  i) honesty
  ii) love
  iii) cooperation
  iv) simplicity

Practice

14.2.9P0 *Specific Objective*
By the end of the sub-module unit, the trainee should be able to illustrate assertiveness, passiveness and aggression

Content

14.2.9P1 Role- play situations and illustrate assertiveness, passiveness and aggression

14.2.10
NEGOTIATION

Theory

14.2.10T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:

a) define the term negotiation
b) explain the importance of negotiation
c) highlight situations that require negotiation
d) discuss possible negotiating techniques
e) e) outline values that are associated with negotiations

Competence

The trainee should have the ability to:

i) Get out of difficult situations
ii) Come up with alternatives

Content

14.2.10T1 Definition of negotiation
14.2.10T2 Importance of negotiation
14.2.10T3 Situations that require negotiations
14.2.10T4 Negotiating techniques
14.2.10T5 Values related to negotiation tolerance
i) responsibility
ii) co-operation
iii) honesty
iv) respect

Practice

14.2.10P0 *Specific Objective*
By the end of the sub-module unit, the trainee should be able to identify negotiation techniques.

Content

14.2.10P1 Watch a video on peace negotiation and identify negotiation techniques

14.2.11 NON-VIOLENT CONFLICT RESOLUTION

Theory

14.2.11T0*Specific Objectives*
By the end of the module sub-unit the trainee should be able to:

a) define the term conflict
b) explain causes of conflicts
c) explain consequences of conflicts
d) state the different types of conflicts
e) explain constructive ways of dealing with conflicts

f) state skills for peaceful conflicts
g) highlight institutions that resolve conflicts in the community
h) outline values in resolving conflicts.

Content

14.2.11T1 Meaning of conflicts
14.2.11T2 Causes of conflicts
14.2.11T3 Consequences of conflicts
14.2.11T4 Types of conflicts (siblings, parents, relatives, communities or clans (etc)
14.2.11T5 Ways of dealing with conflicts
14.2.11T6 Conflict resolution skills
i) empathy
ii) seeking assistance
iii) respect others
iv) assertiveness
v) negotiation
14.2.11T7 Institutions that resolve conflicts in the community
i) courts
ii) religious institutions
iii) committees
iv) council of elders
14.2.11T8 Values related to conflict resolution
i) co-operation
ii) humility
iii) tolerance
iv) responsibility
v) peace as a core value in conflict resolution

Practice

14.2.11P0 *Specific Objective*
By the end of the sub-module unit, the trainee should be able to identify ways of preventing conflicts.

Content

14.2.11P1 Watch video clips on conflict and suggest ways of preventing conflicts

14.2.12 EFFECTIVE DECISION MAKING

Theory

14.2.12T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) discuss situations that require decision making
b) state everyday challenges facing the youth that would require effective decision making
c) outline factors that influence decision making

d) discuss the steps to effective decision making
e) discuss consequences of not making effective decisions
f) highlight decision making institutions within community
g) outline values associated with effective decision making .

Competence

The trainee should have the ability to resolve conflicts peacefully

Content

14.2.12T1 Situations that require decision making

14.2.12T2 Challenges facing the youth such as:
- i) unplanned pregnancies
- ii) peer pressure/peer influence
- iii) drug abuse
- iv) HIV and other Sexually Transmitted Infections
- v) orphaned
- vi) relationships
- vii) career choices

14.2.12T3 Factors that influence decision making
- i) experiences
- ii) uniqueness

14.2.12T4 Steps to effective decision making

14.2.12T5 Consequences of not making effective decisions

14.2.12T6 Decision making institutions within the community
- i) family
- ii) schools /colleges
- iii) courts
- iv) peer arbitrators
- v) religious bodies

14.2.12T7 Values associated with effective decision making
- i) honesty
- ii) integrity
- iii) peace
- iv) kindness

Practice

14.2.12P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to identify challenges facing the youth and suggest ways in which youth can make effective decisions in life

Content

14.2.12P1 Dramatize challenges facing the youth and suggest ways in which youth can make effective decisions in life

Competence

The trainee should have the ability to:

i) Make effective decisions
ii) Weigh options before making decisions.

14.2.13 CRITICAL THINKING

Theory

14.2.13T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) explain the meaning of critical thinking
b) explain the meaning of critical thinking
c) describe risky situations
d) discuss possible ways of evaluating ideas or issues objectively
e) discuss the consequences of making decisions before thinking critically
f) outline values associated with critical thinking.

Content

14.2.13T1 Meaning of critical thinking

14.2.13T1 Risky situations
- i) what constitutes the risk
- ii) pleasurable activities without risks

14.2.13T1 Evaluating ideas/issues objectively
- i) weighing options
- ii) making rational choices

14.2.13T1 Consequences of making decisions before thinking critically
- i) Possibility of falling victim to
- ii) HIV infection
- iii) drug and substance abuse
- iv) unplanned pregnancy
- v) early marriage
- vi) physical and psychological abuse

14.2.13T1 Values associated with critical thinking

Practice

14.2.13P0 *Specific Objective*
By the end of the sub-module unit, the trainee should be able to identify ways of evaluating issues in risky situations.

Competence
The trainee should have the ability to:
i) Think fast and analyse situations before acting
ii) Anticipate consequences.

Content
14.2.13P1 Drama a risky situation and identify ways of evaluating issues objectively

14.2.14 CREATIVE THINKING

Theory

14.2.14 T0 Specific Objectives
By the end of the sub-module unit, the trainee should be able to:
a) define the term creative thinking
b) discuss situations that require creative thinking
c) discuss the importance of being creative
d) highlight the consequences of not being creative
e) state values required in creative thinking.

Competence
The trainee should have the ability to make alternative choices

Content
14.2.14T1 Definition of the term creative thinking
14.2.14T2 Situations/issues that require creative thinking
14.2.14T3 Importance of being creative
14.2.14T4 Consequences of not being creative
14.2.14T5 Associated values

Practice

14.2.14P0 Specific Objectives
By the end of the sub-module unit, the trainee should be able to differentiate between creative thinking and non-creative thinking.

Content

14.2.14P1 Watch video clips with situations on creative thinking and non-creative thinking and differentiate between the two.

14.2.15 PROBLEM SOLVING

Theory

14.2.15T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:

a) explain problem areas that require solutions
b) state causes of problems
c) name tools used in problem solving
d) explain the problem solving process
e) state values necessary solving problems.

Competence

The trainee should have the ability to effectively solve problems

Content

14.2.15T1 Problem areas
i) in school
ii) at home
iii) with peers
iv) in relationships

14.2.15T2 Causes of the problem

14.2.15T3 Tools available for solving problems

14.2.15T4 Problem solving process
i) identify alternative choices
ii) weighing options
iii) action

14.2.15T5 Values required in the problem solving process
i) responsibility
ii) honesty
iii) kindness
iv) love

Practice

14.2.15P0 *Specific Objective*
By the end of the sub-module unit, the trainee should be able to identify and analyze problems.

Content

14.2.15P1 Dramatize problem situations and identify and analyze problems

14.2.16 LEISURE

Theory

14.2.16T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) define leisure and related concepts
b) explain the effects of misuse of leisure time
c) list activities for positive leisure
d) highlight life skills for positive use of leisure
e) outline values associated with leisure.

Competence

The trainee should have the ability to use leisure time positively and constructively

Content

14.2.16T1 Definition of terms:
- i) leisure
- ii) leisure time
- iii) active leisure
- iv) passive leisure

14.2.16T1 Effects of misuse of leisure time
- i) drug and substance abuse
- ii) HIV and AIDS infection
- iii) STDs
- iv) criminal activities

14.2.16T1 Activities for positive leisure
- i) ball games
- ii) athletics
- iii) swimming
- iv) reading
- v) singing

14.2.16T1 Life skills for positive use of leisure time
- i) empathy
- ii) problem solving
- iii) creative thinking
- iv) critical thinking
- v) assertiveness
- vi) negotiation

14.2.16T1 Values associated with leisure
- i) freedom
- ii) tolerance
- iii) humility
- iv) honesty

Practice

14.2.16P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to identify and organize personal leisure time.

Content

14.2.16P1 Critique personal leisure and leisure time and make adjustments

14.2.17 TIME MANAGEMENT

Theory

14.2.17T0 Specific Objectives

By the end of the sub-module unit, the trainee should be able to:

a) define the concepts of time management
b) explain how to make a work schedule
c) explain the components of a time management chart
d) explain the importance of managing time
e) highlight aspects of time robbers
f) state associated values and life skills.

Competence

The trainee should have the ability to:

i) Manage time effectively
ii) Be organized and focused
iii) Achieve set goals
iv) Meet others / clientele's satisfaction

Content

14.2.17T1 Definition of the concepts 'Time Management'

14.2.17T2 Work schedule

14.2.17T3 Components of time management

i) chart to include
ii) leisure time
iii) working time
iv) exercise and games
v) helping the needy
vi) meal times
vii) cleaning time rest

14.2.17T4 Importance of managing time

i) focus on priorities
ii) sense of direction
iii) attain goals
iv) reduce/avoid stress
v) satisfy others/clients

14.2.17T5 Time robbers

i) procrastination
ii) talking too long
iii) lack of priorities
iv) day dreaming
v) excessive playing
vi) Indecisiveness
vii) disorganization
viii) uncontrolled media influence

14.2.17T6 Associated Values and life skills

i) Effective decision making

ii) honesty simplicity
iii) responsibility
iv) Associated Life Skills
v) assertiveness
vi) self awareness
vii) self esteem
viii) communicatio n
ix) decision making

Practice

14.2.17P0 *Specific Objective*
By the end of the sub-module unit, the trainee should be able to:
a) identify time robbers
b) draft a time management chart.

Content
14.2.17P1 Watch video clip and identify time robbers
14.2.17P1 Drafting of a time management chart

14.2.18 GENDER EDUCATION

Theory

14.2.18T0 *Specific Objectives*
By the end of the sub-module unit the trainee should be able to:
a) define the term gender
b) describe various agents that perpetuate gender
c) highlight types of gender stereotypes
d) describe the effect of gender on an individual's life
e) explain possible ways of eliminating gender discrimination
f) outline values associated to gender.

Competence
The trainee should have the ability to eliminate gender discrimination

Content
14.2.18T1 Definition of gender
14.2.18T2 Agents perpetuating gender
14.2.18T3 Gender stereotyping
14.2.18T4 Effects of gender on an individual's life
14.2.18T5 Strategies to eliminate gender discrimination
14.2.18T6 Associated values

Practice

14.2.18P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:

a) identify how culture views men/women/boys/girls
b) list the roles assigned to men and women, boys and girls

Content

14.2.18P1 Watch video clip and identify cultural views on men/women/boys and girls

14.2.18P2 Critique own community and identify roles assigned to men and women, boys and girls

14.2.19 DRUG AND UBSTANCE ABUSE

Theory

14.2.19T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:

a) definition of terms: drug, substance abuse and drug misuse
b) state commonly abused drugs
c) explain the causes of drug and substance abuse
d) highlight signs and symptoms of drug and substance abuse
e) explain the effects of drugs and substance abuse
f) explain the relationship between drug and substance abuse and HIV and AIDS
explain ways of preventing drug and substance abuse
g) explain ways of managing drug and substance abuse cases
h) explain ways of preventing drug and substance abuse
i) outline life skills and values necessary in the prevention and management of drug and substance abuse.

Competence

The trainee should have the ability to:

i) Live a drug free life
ii) Advocate for a drug free society
iii) Assist in rehabilitating drug and substance abusers
iv) Be a role model

Content

14.2.19T1 Definition of terms: drug and substance abuse and drug misuse

14.2.19T2 Commonly abused drugs and substances
alcohol
i) tobacco
ii) bhang
iii) miraa
iv) glue

14.2.19T3 Causes of drug and substance abuse

14.2.19T4 Signs and symptoms of drug and substance abuse.

14.2.19T5 Effects of drug and substance abuse

14.2.19T6 Relationship between drug abuse and HIV and AIDS

14.2.19T7 Management of drug and substance abuse
i) treatment
ii) rehabilitation
iii) re-integration

14.2.19T8 Preventive measures to drug and substance abuse

14.2.19T9 Life skills and values necessary in the prevention of drug and substance abuse
i) life skills
ii) assertiveness
iii) self awareness
iv) self esteem
v) communication
vi) decision making
vii) values
viii) integrity
ix) love
x) freedom
xi) responsibility

Practice

14.2.19P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) identify commonly abused drugs and their street names
b) draft a speech on drug and substance abuse.

Content

14.2.19P1 Identify commonly abused drugs and their street names within community

14.2.19P2 Draft speech on drug and substance abuse and deliver it at a community baraza

14.2.20 HIV AND AIDS

Theory

14.2.20T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) define the terms HIV and AIDS
b) state ways through which HIV is transmitted
c) describe signs and symptoms of AIDS
d) outline the catalysts of HIV and AIDS
e) explain ways of preventing HIV infection
f) explain the interventions for HIV and AIDS
g) outline life skills and values that help in the prevention of HIV and AIDS
h) explain the misconceptions about AIDS
i) explain ways of taking care and supporting the affected and infected
j) discuss factors that facilitate the spread of HIV and AIDS.

Content

14.2.20T1 Definition of terms: HIV and AIDS

14.2.20T2 Ways in which HIV is transmitted

14.2.20T3 Signs and symptoms of AIDS

14.2.20T4 Catalysts of the spread of HIV and AIDS

14.2.20T5 Ways of preventing spread of HIV and AIDS
- i) life skills education
- ii) values
- iii) counselling

14.2.20T6 Interventions of HIV and AIDS

14.2.20T7 Myths and misconception about HIV and AIDS

14.2.20T8 Care and support of the infected and affected

Practice

14.2.20P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) identify HIV catalysts
b) care for and support infected and affected

Competence

The trainee should have the ability to:

i) live a HIV free life
ii) care for an infected person

iii) protect him / herself from infection
iv) advocate for HIV and Aids free society

Content

14.2.20P1 Identifying HIV catalysts within the community and suggest possible interventions

14.2.20P2 Visit a children's home for children infected with HIV and offer psycho-social support

14.2.21 CHILD LABOUR

Theory

14.2.21T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) define terms relating to child labour
b) explain the difference between child labour and child work
c) outline forms of child labour
d) explain factors that lead children to labour
e) outline how to assess the community level of awareness on child labour
f) explain interventions possible to eliminate child labour
g) discuss appropriate life skills in saying "NO" to child labour.

Competence

The trainee should have the ability to:
i) differentiate child work from child labour
ii) put appropriate interventions to worst forms of child labour
iii) work responsibly

Content

14.2.21T1 Definition of terms
i) Child
ii) Child labour
iii) Child work

14.2.21T2 Difference between child labour and child work

14.2.21T3 Forms of child labour
i) herding
ii) selling/peddling drugs
iii) farm hand
iv) hawking
v) transport operators

14.2.21T4 Factors leading to child labour

i) poverty
ii) negligence of parents
iii) ignorance of child rights
iv) orphaned

14.2.21T5 Community level of awareness on child labour
i) are they many or few?
ii) how many are aware?
iii) what are their views in child labour
iv) what are their views about children being engaged in work

14.2.21T6 Possible interventions to eliminate child labour
i) enforcing laws on child rights
ii) rents, children, teachers, employers and communities
iii) educating children through curriculum
iv) empowering community leaders and local administration
v) organizing lobby groups at community levels
vi) setting help/ reporting desks at community levels

14.2.21T7 Associated life skills include:
i) negotiation
ii) assertive
iii) communication
iv) decision making
v) empathy

Practice

14.2.21P0 *Specific Objective*
By the end of the sub-module unit, the trainee should be able to examine levels of awareness of child labour in community.

Content

14.2.21P1 Examine through field trips the levels of community awareness of child labour

14.2.22 CHILD RIGHTS

Theory

14.2.22T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) define terms: human rights, abuse, neglect, labour, needs, ratification
b) discuss types of human needs

c) describe UN conventions on rights of the child
d) describe the categories of child rights
e) explain the importance of child protection and rights
f) explain the responsibilities relating to child rights
g) highlight principles in the right of a child
h) state related values and life skills.

Competence

The trainee should have the ability to:

i) advocate for human rights and protection
ii) intervene in a case of child abuse or child neglect
iii) defend own self in a case of abuse

Content

14.2.22T1 Definition of terms:
- i) human rights
- ii) abuse
- iii) neglect
- iv) labour
- v) needs
- vi) ratification

14.2.22T2 Types of human needs
- i) physical
- ii) psychological

14.2.22T3 UN Convention on the Rights of the Child (1989)
- i) Articles

14.2.22T4 Categories of child rights

14.2.22T5 Importance of child rights and child protection

14.2.22T6 Responsibilities relating to child's rights

14.2.22T7 Principles of child rights
- i) best interests of the child
- ii) rights apply to every child without discrimination on basis of gender race, age, ability, religion

14.2.22T8 Life skills and values associated with child rights

Practice

14.2.22P0 *Specific Objective*
By the end of the sub-module unit the trainee should be able to. identify child rights.

Content

14.2.22P1 Examine through a field trip the responsibilities related to child's

rights in the community

each other in relationships.

14.2.23 RELATIONSHIPS

Theory

14.2.23T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) discuss different types of relationships
b) explain ways of developing healthy relationships
c) state factors that influence the maintenance of healthy relationships
d) explain how to maintain a healthy relationship
e) explain how relationships influence behaviour
f) outline values associated with relationships
g) outline life skills associated with relationships.

Competence
The trainee should have the ability to maintain healthy relationship respect

Content

14.2.23T1 Types of relationships
i) peer/peer
ii) boy/girl; man/woman
iii) siblings relationships
iv) parent/child
v) employee/ employer
vi) client/service provider
vii) husband/wife

14.2.23T2 Developing healthy relationships

14.2.23T3 Factors that influence healthy relationships
i) personality
ii) generation gap
iii) experiences in life

14.2.23T4 Maintaining healthy relationships like waiting until marriage
i) upholding associated values and life skills
ii) self sacrifice

14.2.23T5 Influence of relationship on behaviour
i) negative influence
ii) positive influence

14.2.23T6 Values associated with relationships
i) love
ii) kindness

iii) understanding
iv) responsibility
v) freedom
vi) tolerance

14.2.23T7 Life skills associated with relationships
i) assertiveness
ii) awareness
iii) communication
iv) negotiation
v) peer resistance
vi) friendship formation
vii) coping with stress
viii) coping with emotions
ix) decision making

Practice

14.2.23P0 *Specific Objective*
By the end of the sub-module unit, the trainee should be able to identify different types of relationships

Content

14.2.23P1 Watch video clips and identify healthy relationships

Suggested Learning Resources for the unit

i) Boards
ii) Charts
iii) The computer
iv) Internet
v) Overhead projector
vi) Video tapes
vii) Library
viii) Textbooks
ix) The media
x) Guest speakers

Suggested Learning Activities for the unit

i) Group work presentation
ii) Individual presentation
iii) Drama/role playing
iv) Excursion
v) Observation

Suggested Evaluation Methods for the unit

i) Continuous Assessment Tests (CATs)
ii) Term papers
iii) Questions and answers
iv) Examinations

15.2.0 ELECTRICAL PRINCIPLES II

15.2.01 INTRODUCTION

This module unit is designed to equip the trainee with knowledge, skills and attitudes necessary to understand principles of generating alternating current and appreciate correct usage of electrical measuring instruments.

15.2.02 GENERAL OBJECTIVES

By the end of the module unit, the trainee should be able to;

a) appreciate the value of electrical principles in electrical engineering trade
b) apply acquired knowledge to repair electrical equipment and machinery.
c) observe safety in electronic and electrical engineering work places

15.2.03 MODULE UNIT SUMMARY AND TIME ALLOCATION

ELECTRICAL PRINCIPLES II

Code	Sub Module Unit	Content	Time Hours
15.2.1	Instruments And Measurement	• Essential features of indicating instruments • Construction and operation of indicating instruments • Methods of range extension • Principles of Wheatstone bridge and DC potentiometer • Current, voltage and resistance measurement • Digital meters	28
15.2.2	Principles Of Ac Generation	• Definition of AC terms • Basic principles of AC generation • Types of waveforms	15
15.2.3	Alternating	• Effect of passive	18

	Current(Ac) Circuits	elements on current and voltage • Perform calculations series and parallel circuits • Calculate power in AC circuits	
15.2.4	Direct Current (Dc) Transients	• Effect of inductance on current voltage • growth and decay curves in inductive circuits • time constants in inductive circuits • Effect of capacitance on current and voltage • growth and decay curves in capacitive circuits • time constants in capacitive circuits • calculations on DC transients • application of time constant in an electric circuit	20
15.2.5	Principles Of Three Phase Alternating Current (Ac) Generation And Transmission	• Principles of three-phase generation • Three phase connections • Advantages of three phase system over single-phase system • Calculations on three phase balanced system • Methods of power measurement • Transmission systems	18
Total Time			**99**

15.2.1 INSTRUMENTS AND MEASUREMENTS

Theory

15.2.1T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) describe the essential features of indicating instruments
b) describe the construction and operation of indicating instruments
c) explain methods of range extension
d) explain the principles of the wheat-stone bridge and d.c Potentiometer
e) explain current, voltage and resistance measurement
f) describe digital meters.

Content

15.2.1T1 Essential features of indicating instruments
- i) deflection device
- ii) control device
- iii) damping device

15.2.1T2 Construction and operation of indicating instruments
- i) moving coil
- ii) moving iron
- iii) ohmmeter
- iv) thermocouple

15.2.1T3 Extension of range
- i) shunts
- ii) multipliers
- iii) instrument transformers
- iv) simple calculations

15.2.1T4 Principle of Wheatstone Bridge and d.c Potentiometer
- i) balancing
- ii) standardization

15.2.1T5 Measurement of:
- i) Current
- ii) Voltage
- iii) Resistance
- iv) Ohmmeter
- v) Wheatstone bridge method
- vi) Substitution method
- vii) using voltmeter/ammeter method

15.2.1T6 Digital meters
- i) construction
- ii) principle of operation
- iii) application

Practice

15.2.1P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) identify parts of an indicating instrument
b) safely operate an electrical indicating instrument

c) demonstrate various methods of instruments range extension
d) measure resistance using various methods
e) measure electric quantities using digital meters.

Content

15.2.1P1 Identification of parts of an indicating instrument

15.2.1P2 Operation of an indicating instrument

15.2.1P3 Methods of range extension
i) shunts
ii) multipliers
iii) instrument transformers

15.2.1P4 Resistance measurement
i) Ohmmeter
ii) Ammeter/Voltammeter methods
iii) substitution method
iv) Wheatstone bridge

15.2.1P5 Measurement of electrical quantities using digital meters.
i) Voltage
ii) Current
iii) Resistance
iv) Capacitance
v) Transistor verification

15.2.2 PRINCIPLES OF ATERNATING CURRENT (A.C.) GENERATION

Theory

15.2.2T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) define the various terms applied to a.c generation
b) explain the basic principles of a.c. generations
c) explain different types of wave forms.

Competence
The trainee should have the ability to:
i) Safely take measurements of electrical quantities
ii) Extend instrument range

Content

15.2.2T1 Definition of Terms
i) Alternating quantity
ii) Waveform
iii) Cycle
iv) Frequency
v) Period
vi) Amplitude
vii) Instantaneous value
viii) R.m.s value
ix) Average value

x) Form factor

15.2.2T2 Basic principles of a.c. generation
- i) Components of a.c generator
- ii) Principle of operation
- iii) E.m.f equation

15.2.2T3 Types of waveforms
- i) types
- ii) sketching and interpretation of waveforms
- iii) addition and subtraction
- iv)solution of problems
- v) applications

Practice

15.2.2P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) identify components of an a.c. generator
b) operate an A.C. generator
c) verify the features of an a.c. quantity.

Content

15.2.2P1 Identification of components of a.c. generator

15.2.2P2 Operation of a.c generator

15.2.2P3 Features of an a.c waveform
- i) Cycle
- ii) Frequency
- iii) Period
- iv)Amplitude.

Suggested Learning Resources
- i) A.c generator trainer kit
- ii) C.R.O
- iii) Multi-meter
- iv)A.c generator
- v) Educational trip
- vi)Report writing.

15.2.3 ALTERNATING CURRENT CIRCUITS (A.C.) CIRCUITS

Theory

15.2.3T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) explain the effect of passive elements on current and voltage in a.c. circuits
b) perform calculations on series and parallel circuits
c) calculate power in a.c. circuits.

Content

15.2.3T1 Effects of passive elements on current and voltage
- i) Resistance
- ii) Inductance
- iii) Capacitance
- iv)Waveforms and phasor diagrams

15.2.3T2 Calculations on series and parallel circuits

i) Impedance of Resistor-Capacitor (R-C)circuits
ii) Impedance of Resistor- Inductor-capacitor (R-L-C) circuits
iii) Impedance of Resistor-Inductor (R-L) circuits
iv)Power factor and phase angle
v) Resonance
vi)Q-factor

15.2.3T3 Power in a.c circuit
i) Active power
ii) Reactive power
iii) Apparent power

Practice

15.2.3P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) verify the effects of passive elements on circuit parameters
b) perform experiment to show the effect of power factor.

Content

15.2.3P1 Effects of R – L – C on voltage and current in a.c. circuit
i) Series circuits
ii) Parallel circuits

15.2.3P2 Experiment on power factor

Suggested Learning Resources
i) capacitors, resistors, inductors
ii) measuring instruments
iii) Cathode Ray Oscilloscope (C.R.O)
iv)AC trainer circuit kit

15.2.4 DIRECT CURRENT (D.C.) TRANSIENTS

Theory

15.2.4T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) explain the effect of inductance on current and voltage
b) sketch growth and decay curves in inductive circuits
c) describe time constant in inductive circuits
d) explain effect of capacitance on current and voltage
e) sketch growth and decay curves in capacitive circuits
f) describe time constant in capacitive circuits
g) perform simple calculations on d.c Transients
h) state the application of time constant in an electrical circuit.

Competence

i) The trainee should have the ability to:
ii) Attain resonance
iii) Perform power factor correction

Content

15.2.4T1 Effect of inductance on current and voltage
i) steady state
ii) transient state

15.2.4T 2 Time constant in inductive circuits
i) definition

15.2.4T 3 Growth and decay curves in inductive circuits

15.2.4T 4 Effects of capacitance on current and voltage
i) steady state

15.2.4T 5 Growth and decay curves in capacitive circuits

15.2.4T 6 Time constant in capacitive circuits
- Definition

15.2.4T 7 Simple calculations on d.c transient
i) steady state currents
ii) transient currents

15.2.4T8 Applications of time constant

Practice

15.2.4P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to plot the growth and decay curves for inductive and capacitive circuits to determine the time constants.

15.2.4P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to plot the growth and decay curves for inductive and capacitive circuits to determine the time constants.

Content

15.2.4P 1 Growth and decay curves
i) R-C circuit
ii) R-L circuit

Competence

The trainee should have the ability to plot growth and decay curves for R-L and R-C circuits

Suggested Learning Resources

i) drawing instruments
ii) graph paper
iii) CRO
iv)Electronic components

15.2.5 PRINCIPLES OF THREE PHASE ALTERNATING CURRENT (A.C.) GENERATION AND TRANSMISSION

Theory

15.2.5T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) explain the principles of three-phase generation
b) describe various methods of three phase connections
c) state advantages of three phase over single phase generation
d) perform simple calculations on three phase balanced systems
e) describe methods of power measurement in three phase balanced systems
f) describe various transmission systems.

Competence

The trainee should have the ability to:

i) Connect star and delta arrangements
ii) Measure line and phase values in star and delta connections
iii) Measure power in three phase circuits

Content

15.2.5T 1 Principle of three phase generation
- i) Three phase windings
- ii) Rotating field
- iii) Electromagnetic induction
- iv) Waveforms

15.2.5T2 Three phase connections
- i) Star
- ii) Delta
- iii) Line and phase values

15.2.5T3 Advantages of three phase over single phase systems

15.2.5T 4 Calculations on three phase balanced systems

15.2.5T5 Methods of power measurement
- i) One wattmeter method
- ii) Two wattmeter method
- iii) Three wattmeter method

15.2.5T6 Description of various transmission systems
- i) Single phase two-wire
- ii) Three phase 3 – wire
- iii) Three phase 4 – wire
- iv) Transmission voltages

Practice

15.2.5P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) connect three phase circuits
b) measure line and phase values
c) measure power in three phase circuits.

Content

15.2.5P1 Connection of star and delta circuits

15.2.5P2 Measurement of line and phase values in star and delta connections

15.2.5P3 Measurement of power in three phase circuits

i) one wattmeter
ii) two wattmeter
iii) three wattmeter

Suggested Learning Resources

i) measuring instruments
ii) charts
iii) A.C. generation trainer kits

16.2.0 COMMUNICATION SKILLS

16.2.01 INTRODUCTION

This module unit is intended to equip the trainee with knowledge, skills and attitudes to enable him/her to perform duties, process information from a variety of sources and apply communication skills at the work place.

16.2.02 GENERAL OBJECTIVES

By the end of the module unit, the trainee should be able to:

a) Appreciate the importance of communication in the work place
b) Develop necessary skills for effective communication
c) Appreciate the use of different modes and forms of communication
d) Appreciate the role of information and communication technology in communication
e) Develop the necessary writing skills for various documents
f) Appreciate official etiquette, protocol and diplomacy at the work place
g) Appreciate emerging issues in communication

16.2.03 MODULE UNIT SUMMARY AND TIME ALLOCATION

COMMUNICATION SKILLS

Code	Sub-Module Unit	Content	Time Hrs
16.2.1	Introduction To Communication	• Terms and concept used • Essentials to effective communication • Role of ICT in communication	4
16.2.2	Communication Process	• Stages of communication process • Barriers to effective communication • Ways of overcoming barriers • Basic concepts of transmission	

		and receipt of a message • Feedback mechanism • Ethical issues in communication	2
16.2.3	Classification Of Communication	• Types of communicatio0n • Use of various types of communication	4
16.2.4	Forms Of Communication	• Forms of communication • Advantages and disadvantages of	4
16.2.5	Channels Of Communication	• Communication channels • Advantages and disadvantages	5
16.2.6	Official Etiquette, Protocol And Diplomacy	• Meaning of etiquette, protocol and diplomacy	5
16.2.7	Writing Skills	• Punctuation marks • Courtesy in writing • Paragraph development • Essay writing • Functional writing	10
16.2.8	Summary	• Importance of summary writing • Essential steps in summary writing	4
16.2.9	Report Writing Skills	• Definition of a report • Role of reports • Formats of reports • Preparation for report writing • Report writing , editing and dissemination • Referencing styles • Preparation of power point slides	8
16.2.10	Conducting Meetings And Minute Writing	• Definition of terms • Role of meetings and minutes • Types of meetings • Planning and conducting meetings • Minute writing • Challenges in conducting	8

		meetings	
16.2.11	Interviews	• Meaning of the term interview • Purpose of interviews • Types of interviews • Preparation for an interview • Interviewing skills	4
16.2.12	Public Relations And Customer Care	• Definition of term • Types of customers • Role of public relations and customer care • Interpersonal and public relation skills • Quality management • Customer care skills • Challenges faces in public relation and customer care	4
16.2.13	Emerging Issues In Communication	• Emerging trends and issues in communication • Challenges posed by emerging issues and trends • Ways of coping with emerging issues and trends	4
Total			**66**

16.2.1 INTRODUCTION TO COMMUNICATION

Theory

16.2.1T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) define terms and concepts used in communication
b) explain the purpose of communication
c) explain the essential steps to effective communication
d) explain the role of Information and Communication Technology (I.C.T.) in communication.

Content
16.2.1T1 Terms and concepts used in communication
16.2.1T2 Purpose of communication
16.2.1T3 Essentials to effective communication
16.2.1T4 Role of I.C.T. in communication

Practice

16.2.1P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) use terms and concepts in communication effectively
b) apply essentials of communication in a given situation.

Content
16.2.1P1 Effective use of terms and concepts in communication
16.2.1P2 Application of essentials of communication

Competence
The trainee should have the ability to use the terms and concepts in communication effectively in different situations.

16.2.2 COMMUNICATION PROCESS

Theory

16.2.2T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) describe the stages of the communication process
b) identify barriers to effective communication
c) explain ways of overcoming barriers to effective communication

d) identify basic concepts of transmission and receipt of a message
e) describe feedback mechanism
f) explain ethical issues in communication.

Competence
The trainee should have the ability to
i) Apply communication process in a given situation
ii) Overcome barriers to effective communication

Competence
The trainee should have the ability to apply the various types of communication in a given situation

Content

16.2.2T1 Stages of communication process

16.2.2T2 Barriers to effective communication
i) Age difference
ii) Social economic factors
iii) Language
iv) Competition for attention
v) Noise
vi) Environment
vii) Attitude of sender/receiver and others

16.2.2T3 Ways of overcoming barriers to effective communication

16.2.2T4 Basic concepts of transmission and receipt of a message
i) Encoding of message by the sender
ii) Transmission of message through a channel
iii) Decoding a message by receiver
iv) Decoding of feedback by the sender

16.2.2T5 Feedback mechanism

16.2.2T6 Ethical issues in communication

Practice

16.2.2P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
c) apply the communication process in a given situation
d) encode and decode messages
e) demonstrate ethical issues in communication

Content

16.2.2P1 Application of the process of communication

16.2.2P2 Encoding and decoding messages

16.2.2P3 Demonstration of ethical issues in communication

16.2.3 CLASSIFICATION OF COMMUNICATION

Theory

16.2.3T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) explain the various types of communication
b) explain the use of various types of communication.

Content

16.2.3T1 Types of communication

i) Formal
ii) Informal
iii) Internal
iv) External
v) Inter personal
vi) Intra-personal

16.2.3T2 Use of various types of communication

Practice

16.2.3P0 *Specific Objective*

By the end of the sub-module unit, the trainee should be able to apply the various types of communication in given situations.

Content

16.2.3P1 Application of various types of communication

16.2.4 FORMS OF COMMUNICATION

Theory

16.2.4T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) explain the various forms of communication
b) discuss the advantages and disadvantages of each form of
c) communication.

Competence

The trainee should have the ability to use various forms of communication effectively

Content

16.2.4T1 Forms of communication

i) Oral
ii) Written
iii) Visual

iv) Audio-visual

16.2.4T2 Advantages and disadvantages of each form of communication

Practice

16.2.4P0 *Specific Objective*
By the end of the sub-module unit, the trainee should be able to use the various forms of communication.

Content

16.2.4P1 Using various forms of communication

16.2.5 CHANNELS OF COMMUNICATION

Theory

16.2.5T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:

a) outline the various channels of communication in an organization
b) discuss the advantages and disadvantages of each channel of
c) communication.

Competence
The trainee should have the ability to apply various channels of communication in a given situation

Content

16.2.5T1 Channels of communication
i) Vertical
ii) Upwards
iii) Downwards
iv) Lateral/horizontal
v) Diagonal

16.2.5T2 Advantages and disadvantages of each channel of communication

Practice

16.2.5P0 *Specific Objective*
By the end of the sub-module, the trainee should be able to role play the use of different channels of communication.

Content

16.2.5P1 Role play of use of different channels of communication

16.2.7 OFFICIAL ETIQUETTE, PROTOCOL AND DIPLOMACY

Theory

16.2.6T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:

a) explain the meaning of etiquette, protocol and diplomacy
b) explain the importance of official etiquette
c) explain the accepted protocol and diplomacy.

Competence
The trainee should have the ability to:
i) Interact with others without offending
ii) Observe protocol requirements
iii) Exercise diplomacy in daily interactions
iv) Adhere to official etiquette requirements

Content
16.2.6T1 Meaning of etiquette, protocol and diplomacy
16.2.6T2 official etiquette
16.2.6T3 Accepted protocol and diplomacy

Practice

16.2.6P0 Specific objective
By the end of the sub-module unit, the trainee should be able to practice the accepted official etiquette.

Content

16.2.6P1 Demonstration of accepted official etiquette

16.2.7 WRITING SKILLS

Theory

16.2.7T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) determine how to use punctuation marks in a written document
b) explain the importance of courtesy in writing
c) develop well constructed paragraphs
d) explain how to write different types of essays
e) determine how to write different functional writing.

Competence
The trainee should have the ability to:
i) Punctuate correctly
ii) Prepare business documents

Content
16.2.7T1 Punctuation marks
16.2.7T2 Courtesy in writing

i) Use of polite language
ii) Choice of words
iii) Right expressions

16.2.7T3 Paragraph development
i) sub-module unit sentence
ii) Support details

16.2.7T4 Essay writing
i) Descriptive
ii) Explanatory
iii) Narrative
iv) Argumentative

16.2.7T5 Functional writing
i) Business letters
ii) Memorandum
iii) Notices
iv) Agenda
v) Minutes
vi) Advertisements
vii) E-mail
viii) Facsimile messages
- Press release

Practice

16.2.7P0 *Specific objectives*
By the end of the sub-module unit, the trainee should be able to:
a) use correct punctuation
b) apply courtesy in writing
c) write different types of essays
d) write different types of functional writing.

Content

16.2.7P1 Punctuating correctly
16.2.7P2 Demonstrating courtesy in writing
16.2.7P3 Writing different types of essays
16.2.7P4 Writing different functional writing

16.2.8 SUMMARY

Theory

16.2.8T0 Specific Objectives
By the end of the sub-module unit, the trainee should be able to:
a) explain the importance of summarizing passages/information
b) determine the steps in note taking when summarizing passages,
c) reports and conversations.

Competence
Ability to summarize passages, reports and conversations

Content

16.2.8T1 Importance of summary writing

16.2.8T2 Essential steps in summary writing

Practice

16.2.8P0 *Specific Objective*
By the end of the sub-module unit, the trainee should be able to take notes and summarize passages, reports and conversations

16.2.8P1 Summarizing passages, reports and conversations.

16.2.9 REPORT WRITING SKILLS

Theory

16.2.9T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:

a) define the term report
b) explain the role of reports in an organization
c) name different types of reports
d) explain the formats of reports
e) explain the steps to take in preparation for report writing in engineering
f) explain how to write, edit and disseminate reports
g) explain the referencing styles used in engineering reports
h) prepare power point presentations.

Competence
The trainee should have the ability to:

i) Prepare effective reports
ii) Adapt reports to various audiences
iii) Apply I.C.T. in report writing, editing and dissemination
iv) Present reports using power point presentations
v) Select appropriate referencing styles in engineering

Content

16.2.9T1 Definition of a report

16.2.9T2 Role of reports in an organization

16.2.9T3 Types of reports

i) Oral
ii) Written
iii) Management reports
iv) Operations procedures
v) Production schedules
vi) Maintenance, breakdown and accident reports
vii) Entrepreneurship and trade reports

viii) Internal memos

16.2.9T4 Formats of reports

16.2.9T5 Preparation for report writing
- i) Audience analysis
- ii) Reading skills
- iii) Data collection
- iv) Data analysis

16.2.9T6 Report writing, editing and dissemination

16.2.9T7 Referencing styles

16.2.9T8 Preparation of power point slides

Practice

16.2.9P0 *Specific objectives*

By the end of the sub-module unit, the trainee should be able to:
- a) prepare different types of reports
- b) edit and disseminate reports
- c) present a report through power point slides.

Content

16.2.9P1 Preparation of different types of reports

16.2.9P2 Editing and dissemination of reports

16.2.9P3 presenting a report

16.2.10 CONDUCTING MEETINGS AND MINUTE WRITING

Theory

16.2.10T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:
- a) define the terms meetings and minutes
- b) explain the role of meetings and minutes in an organization
- c) identify types of meetings
- d) discuss how to plan and conduct meetings
- e) highlight the challenges faced in the conduct of meetings and minute writing
- f) discuss the advantages and disadvantages of meetings.

Competence

The trainee should have the ability to:
- i) Plan and conduct meetings
- ii) Write minutes effectively

Content

16.2.10T1 Definition of the terms meetings and minutes

16.2.10T2 Role of meetings and minutes in an organization

16.2.10T3 Types of meetings
16.2.10T4 Planning and conducting meetings
16.2.10T5 Challenges in conduct of meetings and minute writing
16.2.10T6 Advantages and disadvantages of meetings

Practice

16.2.10P0 *Specific objective*
By the end of the sub-module unit, the trainee should be able to write minutes correctly.

Content
16.2.10P1 Writing minutes

16.2.11 INTERVIEWS

Theory

16.2.11T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) explain the meaning of the term 'interview'
b) explain the purpose of interviews in an organization
c) discuss the various types of interviews
d) explain how to prepare for an interview
e) explain the skills for interviewing.

Competence
The trainee should have the ability to:
i) Conduct interviews
ii) Prepare for an interview as an interviewee
iii) Prepare for an interview as an interviewer

Content
16.2.11T1 Meaning of the term 'interview'
16.2.11T2 Purpose of an interviews in an organization
16.2.11T3 Types of interviews
16.2.11T4 Preparation for an interview
i) Dressing and grooming
ii) Role of interviewer
iii) Role of interviewee
iv) Interview environment
16.2.11T5 Interviewing skills
i) Briefing skills
ii) Conducting the interview
iii) Debriefing skills

Practice

16.2.11P0 *Specific Objective*
By the end of the sub-module unit, the trainee should be able to role play as an interviewer and as an interviewee.

Content

16.2.11P1 Role playing the interviewer and interviewee

16.2.12 PUBLIC RELATIONS AND CUSTOMER CARE

Theory

16.2.12T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) define the terms public, customer and public relations
b) name different types of customers
c) explain the role of public relations and customer care in an
d) organization
e) explain interpersonal and public relations skills
f) define quality management
g) explain the skills in customer care
h) explain the challenges faced in public relations and customer care.

Competence

The trainee should have the ability to:

i) Demonstrate proper public relations
ii) Interact with different types of people
iii) Care for customers appropriately

Competence

The trainee should have the ability to cope with emerging trends and issues

Content

16.2.12T1 Definition of the terms public, customer and public relations
16.2.12T2 Types of customers
16.2.12T3 Role of public relations and customer care in an organization
16.2.12T4 Interpersonal and public relations skills
16.2.12T5 Quality management
16.2.12T6 Customer care skills
16.2.12T7 Challenges faced in public relations and customer care

Practice

16.2.12P0 *Specific Objective*

By the end of the sub-module unit, the trainee should be able to apply public relation skills in dealing with the various people.

Content

16.2.12P1 Application of public relation skills

16.2.13 EMERGING ISSUES IN COMMUNICATION

Theory

16.2.13T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

c) state emerging trends and issues in communication
d) outline challenges posed by emerging issues
e) explain ways of coping with emerging trends and issues in communication.

Content

16.2.13T1 Emerging trends and issues in communication

16.2.13T2 Challenges posed by emerging trends and issues

16.2.13T3 Ways of coping with the emerging trends and issues

Suggested Teaching/Learning Activities

i) Group work/presentations
ii) Debating
iii) Observations
iv) Listening to lecturers/resource persons
v) Drama/role playing
vi) Excursions

*Suggested Teaching/*Learning *Resources*

i) Boards
ii) Charts
iii) Language laboratory
iv) Machines and equipment
- Power point
- Projectors
- Audio tapes
- Telephone/fax
- E-mail
- Internet

v) Lecturers and resource persons
vi) Library
vii) Newspapers/magazine-s/journals

Suggested Evaluation Methods

i) Continuous assessment tests
ii) Term papers
iii) Questions and answers
iv) Examinations – written/oral

17.2.0 WORKSHOP ORGANISATION AND MANAGEMENT

17.2.1 INTRODUCTION

This unit is intended to equip the trainee with knowledge, skills and attitudes relating to management of resources production, marketing and industrial relations.

17.2.2 GENERAL OBJECTIVES

By the end of the unit, the trainee should be able to:

a) appreciate importance of proper management methods.
b) apply management skills
c) embrace quality control and inspection checks
d) understand company law and industrial relations
e) acquire proper marketing skills

17.2.3 MODULE UNIT SUMMARY AND TIME ALLOCATION

WORKSHOP ORGANISATION AND MANAGEMENT

Code	Sub-Module Unit	Content	Time Hrs
17.2.1	Management Concepts	• Definition of management • Functions of management • Contribution of pioneers of management • Role of industries in society	**6**
17.2.2	Production, Planning and Control	• Distinction between production, planning and control • Types of production, planning and control • Objectives of production, planning and control • Documents in production, planning and control • Stages in production, planning and control • Factors to maximize productivity	**6**
17.2.3	Work Study	• Definition of work-study • Techniques of work-study • Objectives of work-study • Operating time and comparative	**8**

		time processes • Factors affecting plant and machinery layout	
17.2.4	Quality Control and Inspection	• Principles of quality control • Objectives of inspection • Importance of inspection • Inspection methods	**6**
17.2.5	Procurement	• Direct costs • Indirect costs • Job costing • Functions of purchasing • Elements of stock control • Tendering process	**4**
17.2.6	Marketing	• Definition of marketing • Importance of marketing • Distribution and sales promotion methods • Factors determining consumer behavior	**6**
17.2.7	Company Law and Industrial Relations	• Legislation on company • Law of contracts • Law of torts • Historical development of industry • Legal requirements of industry in Kenya • Wages and working conditions	**9**
Total Time			**44**

17.2.1 MANAGEMENT CONCEPTS

Theory

17.2.1T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) define term management
b) outline functions of management
c) explain the contributions of the pioneers of management in the development of management
d) explain the role of industry in the society.

Content
17.2.1T1 Definition of management
17.2.1T2 Functions of management
i) Forecasting
ii) Planning
iii) Organizing
iv) Motivating
v) Coordinating
vi) Controlling
17.2.1T3 Contribution of pioneers of management
i) Reter Drucker
ii) Rensis
iii) Chris Argyris
iv) Hezberg
17.2.1T4 Role of industry
Social services

Competence
The trainee should have the ability to:
i) Display knowledge of the management structure in his/her place of work
ii) Create good organization structure in place of work
iii) Display management skills in place of work

Suggested learning resources
i) Charts
ii) Text books
iii) Audio visual aids
iv) Internet

17.2.2 PRODUCTION PLANNING AND CONTROL

17.2.2T0 Specific Objectives
By the end of the sub-module unit, the trainee should be able to:
a) distinguish between production planning and control
b) explain types and objectives of production planning and control
c) state documents required in production planning and control

d) explain stages of production planning and control
e) explain the factors which maximize productivity.

Competence
The trainee should have the ability to Select suitable production method
i) Employ production, planning and control documents

Competence
The trainee should have the ability to:
i) carry out work study
ii) select plant and machinery layout

Content

17.2.2T1 Distinction between production planning and control

17.2.2T2 Types and objectives of production, planning and control
i) Types
ii) Job
iii) Batch
iv) Process
v) Plan
vi) Mass
vii) Charts
viii) Job tickets
ix) Corrective
x) Objectives
xi) Delivery dates
xii) Continuous production
xiii) Effective use of manpower and equipment
xiv) Prevention of bottle necks
xv) Raw materials and work in progress

17.2.2T3 Documents in production, planning and control
i) work order (route card)
ii) demand note
iii) control sheet
iv) delivery notes
v) progress or make notes

17.2.2T4 Stages in production, planning and control
i) scheduling
ii) loading
iii) materials
iv) dispatching
v) progressing

17.2.2T5 Maximum productivity
i) sales
ii) research
iii) production efficiency
iv) employees disputes
v) plant and machinery in use

Suggested Learning Resources
i) charts
ii) production, planning and control documents
iii) internet

17.2.3 WORK STUDY

17.2.3T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) define work study
b) explain techniques of work study
c) state objectives of work study
d) distinguish between operating times and comparative costs
e) processes
f) state factors considered plant and machinery layout

Content

17.2.3T1 Definition of work-study

17.2.3T2 Techniques of work-study
i) Method study
ii) Work measurement

17.2.3T3 Objectives of work-study
i) Productivity
ii) Costs
iii) Labour
iv) Materials
v) Machines
vi) Layout

17.2.3T4 Operating time and comparative time processes
i) Standard times
ii) Experience of operators
iii) Power consumption

17.2.3T5 Factors considered for plant and machinery layout
i) Type and purpose of machines
ii) Size and cost
iii) Space
iv) Flow of materials
v) Transport entry and exit
vi) Power and water resource
vii) Noise segregation

Suggested learning resources
i) Charts
ii) Audio displays
iii) Industrial visits

17.2.4 QUALITY CONTROL AND INSPECTION

17.2.4T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) describe the principles of quality control
b) explain the objectives of inspection
c) explain the importance of inspection
d) describe inspection methods

Content

17.2.4T2 Principles of quality control

17.2.4T3 Objectives of inspection
- i) Efficiency
- ii) Dimension
- iii) Appearance
- iv) Durability

17.2.4T5 Importance of inspection
- i) Reputation
- ii) Avoidance of unnecessary work
- iii) Incentive payment
- iv) Location of faults and avoidance of poor
- v) workmanship

17.2.4T6 Inspection methods
- i) Floor inspection
- ii) Central inspection
- iii) Final inspection

Suggested Learning Resources
- i) Charts
- ii) Audio displays
- iii) Industrial visits

17.2.5 PROCUREMENT

17.2.5T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
- a) distinguish between direct and indirect costs
- b) cost jobs
- c) explain functions of purchasing
- d) explain elements of stock control
- e) explain tendering processes

Competence
The trainee should have the ability to:
- i) Estimate cost of work
- ii) Compete in tendering process
- iii) Enter in contract
- iv) Procure material required for specific contract

Content

17.2.5T1 Direct costs
- i) Materials
- ii) Labour
- iii) Direct expenses

17.2.5T2 Indirect costs
- i) Storage
- ii) Selling
- iii) Distribution
- iv) Administration

17.2.5T3 Calculation of cost of jobs
- i) Direct costs
- ii) Indirect costs
- iii) Total cost

17.2.5T4 Purchasing functions
- i) Coordination
- ii) Factors controlling purchasing
- iii) Purchasing networks
- iv) quality of a purchasing office

17.2.5T6 Stock control elements
- i) Scope of stock control
- ii) Stores procedure

iii) Principles of stores layout

17.2.5T5 Tendering processes
i) Forms of tender
ii) Methods of tendering
iii) Bid documents
iv) Evaluation of bid documents
v) Submission of bid documents
vi) Legislation governing tendering
vii) Legal contracts

Suggested Learning Resources
i) charts
ii) purchasing documents
iii) internet

17.2.6 MARKETING

17.2.6T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) define the term marketing
b) explain the importance of marketing
c) explain methods of distribution and sale promotions
d) describe factors affecting consumer behaviour

Content
17.2.6T 1 Definition of marketing
17.2.6T 2 Importance of marketing
17.2.6T 3 Distribution and sales promotions methods
17.2.6T 4 Factors that determine consumer behaviour

Suggested learning resources
i) Tender documents
ii) Charts
iii) Internet facilities

17.2.7 COMPANY LAW AND INDUSTRIAL RELATIONS

17.2.7T0 *Specific Objectives*
By the end of the unit, the trainee should be able to:
a) explain the legislation on company
b) explain law of contracts
c) explain law of torts
d) discuss historical development of industry
e) state legal requirements of industry in Kenya
f) explain wages and working condition in industry

Competence
The trainee should have the ability to:
i) Bargain in industrial disputes

ii) Formulate wages and salaries

Contents

17.2.7T1 Legislation on company
- i) Company formation
- ii) Types
- iii) Limited liability
- iv) Partnership
- v) Sole proprietorship
- vi) Methods of raising capital
- vii) Registration of company

17.2.7T2 Law of contracts
- i) Nature of contract
- ii) Type of contract
- iii) Void
- iv) valid contract
- v) Element of a contract
- vi) Mutilating factors
- vii) Privacy of contracts
- viii) Negotiable instruments
- ix) Discharge of contracts
- x) Remedies

17.2.7T3 Law of torts
- i) Elements of torts
- ii) Defence of tort
- iii) Parties to tort
- iv) Vicarious liability
- v) Occupier's liability
- vi) Strict liability
- vii) Special torts
- viii) Remedies for torts
- ix) Limitation of action

17.2.7T4 Historical development of industry
- i) Evolution of trade union movement
- ii) Pioneers of trade union movement
- iii) Industrial disputes
- iv) Procedure for solving industrial disputes

17.2.7T5 Legal requirement for industry
- i) Factory act special regulations
- ii) Workman's compensation Act

17.2.7T6 Wages and working conditions
- i) Wages
- ii) Types of remuneration
- iii) Guidelines for establishing salaries and wages
- iv) Common remuneration systems
- v) Working condition
- vi) Condition of employment
- vii) Fringe benefits

Suggested learning resources
- i) Charts on function of COTU, PRE and ILO
- ii) Internet
- iii) Newspapers

18.2.0 MATHEMATICS II

18.2.01 INTRODUCTION

This module unit is intended to equip the trainees with relevant mathematical knowledge, skills and attitudes to enhance their analytical skills and understanding in Electrical and Electronic sciences and other areas of the trade. Trainees undertaking this unit require to have completed Mathematics I of this course.

18.2.02 GENERAL OBJECTIVES

By the end of the module unit, the trainee should be able to:

a) understand mathematical concepts relevant to electrical and electronic trade
b) apply mathematical concepts to solve problems
c) appreciate mathematics as a tool for technological development

18.2.0 MODULE UNIT SUMMARY AND TIME ALLOCATION

MATHEMATICS II

Code	Sub Module Unit	Content	Hrs
18.2.1	Algebra	• Simultaneous equations Quadratic equations Binomial theorem	10
18.2.2	Trigonometry and Hyperbolic Functions	• Trigonometric ratios • Factor formulae • Solution of triangles • Trigonometric equations • Hyperbolic functions	18
18.2.3	Vector	• Vector algebra and theorems • Dot and cross products • Gradient, divergence and curl of scalar and • vector functions	12
18.2.4	Matrices II	• Matrix operations	14

		• Determinants • Cofactor • Crammer's rule • Inverse of 3x3 matrix • Solution of simultaneous equations	
18.2.5	Calculus	• Differentiation and its applications • Integration	12
Total Time			**66**

18.2.1 ALGEBRA

18.2.1T0 *Specific Objectives*
By the end of this unit, the trainee should be able to:
a) solve linear simultaneous equations
b) reduce equations to quadratic equations
c) solve quadratic equations
d) state and use the binomial theorem
e) apply binomial theorem to estimate errors of small changes

Content
18.2.1T1 Solution of linear simultaneous equations
18.2.1T 2 Reduction of equations to quadratic equations
18.2.1T 3 Solution of equations reduced to quadratic equations
18.2.1T 4 Statement and use of binomial theorem
18.2.1T 5 Application of binomial theorem to estimate errors

18.2.2 TRIGONOMETRY AND HYPERBOLIC FUNCTIONS

18.2.2T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) define trigonometrical ratios, compound angles, double angles and factor formulae
b) solve right angled triangular trigonometrical equations
c) define hyperbolic ratios,
d) state Osborne's rule and solve hyperbolic equations

Content
18.2.2T1 Trigonometric ratios
i) Sketches
ii) Compound formulae
iii) Deviation of factor formulae
18.2.2T2 Solution of right angled triangle parameters
18.2.2T3 Definition of hyperbolic ratios
18.2.2T1 Osborne's rule
i) Statement
ii) Application

18.2.3T VECTOR

18.2.3T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) define a vector and scalar
b) distinguish between a vector and scalar quantity

c) define vector theorems
d) solve problems involving the dot and cross products
e) solve problems on gradient, divergence and curl operators

Content

18.2.3T 1 Definition of a vector and scalar

18.2.3T 2 Distinction between a vector and scalar quantity

18.2.3T 3 Definition of vector theorem
i) Resolution
ii) Proof of ratio theorem
iii) Application of ratio theorem

18.2.3T 4 Solution of problems on dot and cross products

18.2.3T T5 Gradient, divergence and curl operators
i) Definition
ii) Calculations

18.2.4 MATRICES II

18.2.4T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) Perform 3x3 matrix operations
b) Determine the determinant of a 3x3 matrix using co-factor method and Sirus rule
c) Solve a problem using crammers rule
d) Determine the inverse of a 3x3 matrix
e) Apply matrices in solving linear simultaneous equations with three unknowns

Content

18.2.4T1 Performing 3x3 matrix operations

18.2.4T2 Determination of determinant of a 3x3 matrix using:
i) Co-factor method
ii) Sirus rule

18.2.4T3 Solution of problems using Cramer's rule

18.2.4T4 Determination of the inverse of a 3x3 matrix

18.2.4T5 Application of matrices in solving linear simultaneous equations with three unknowns

18.2.5 CALCULUS

18.2.5T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) define the derivative of a function
b) find derivative of a function from the first principles

c) refer to the table of derivatives of common functions d) state and use rules of differentiation e) determine higher derivatives f) define partial derivatives of a function of two variables g) solve problems involving small changes or errors using partial derivatives h) determine stationary points of functions of two variables i) integrate equations		*Content* Definition of differentiation Determination of derivatives (Xn , trigonometric) Reference to tables of derivatives Rules of differentiation Determination of higher derivatives Definition of partial derivatives Solution of problems involving small changes Determination of stationary points Integration i) X n ii) Trigonometric functions
	18.2.5T1 18.2.5T2 18.2.5T3 18.2.5T4 18.2.5T5 18.2.5T6 18.2.5T7 18.2.5T8 18.2.5T9	

19.2.0 MICRO ELECTRONICS

19.2.1 Introduction

This unit is designed to equip the trainee with knowledge, skills and attitudes on computer hardware memories and programming. This module unit is based heavily on Intel 8085 microprocessor. Trainees require basic electronic to improve the understanding of the content of this unit.

19.2.02 General Objectives

By the end of the module unit, the trainee should be able to:

a) understand components of a microcomputer system.
b) embrace a culture of computer maintenance
c) discuss evolution of microprocessors
d) appreciate microcomputer memories
e) develop computer programs

19.2.3 Module Unit Summary and Time Allocation

Micro Electronics

Code	Sub-Module Unit	Content	Time
19.2.1	Micro-Processor System	• Micro-computer terminologies • Components of computer system	6
19.2.2	Microprocessor Evolution And Architecture	• Microprocessor families and their characteristics • Intel 8085 microprocessor architecture	10
19.2.3	Microcomputer Memories	• Memory terminologies • Construction of primary memories • Memory organization • Backing store memories	15
19.2.4	Programming	• Assembly language program • Hand coding	24
Total Time			**55**

19.2.1 MICRO PROCESSOR SYSTEM (INTEL 8085)

Theory

19.2.1T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) define terms applied in microprocessor system
b) describe computer system hardware components

Competence
The trainee should have the ability to:
i) Assemble a computer system
ii) Install software
iii) Maintain a computer system

Content
19.2.1T1 Definition of terms
i) Microprocessor
ii) Microprocessor system
iii) Hardware
iv) software

19.2.1T2 Components of a computer system
i) block diagrams
ii) central processing unit
iii) I/O ports and devices
iv) memory
v) bus system

Practice

19.2.1P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) identify parts of a microprocessor system
b) assemble a computer system
c) install computer system software
d) maintain a computer system

Content
19.2.1P1 Identification of parts of a computer system
19.2.1P2 Assembly of a computer system
19.2.1P3 Installation of a computer system soft ware
19.2.1P4 Computer maintenance

Suggested Learning Resources
i) Computer system
ii) Computer software

19.2.2 MICROPROCESSOR EVOLUTION AND ARCHITECTURE

Theory

19.2.2T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) state microprocessor families and their characteristics
b) describe using block diagrams, the microprocessor architecture of Intel 8085 CPU

Competence

The trainee should have the ability to:

i) Identify and install a CPU in a computer system

Content

19.2.2T1 Statement of microprocessor families and their characteristics

i) Intel corporation
ii) 8085,8080,8086, 8088
iii) Pentium I, II, III, IV
iv) Zilog corporation
v) Z80
vi) Motorola
vii) MC6800

19.2.2T2 Description of Microprocessor architecture of Intel 8085 CPU

i) pin description diagram
ii) internal structure
iii) register section
iv) Arithmetic and Logic Unit (ALU)
v) Instruction and decode unit

Practice

19.2.2P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) identify a microprocessor in a computer system
b) identify pins in a microprocessor chip

Content

19.2.2P1 Identification of a microprocessor

i) Physical location

19.2.2P2 Microprocessor pin description

i) Pin layout

Suggested teaching and learning resources

i) Various types of computer processing units
ii) Computers

19.2.3 MICROCOMPUTER MEMORIES

Theory

19.2.3T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) define terminologies used in memories

b) describe the construction and operation of primary memory
c) explain computer memory organization
d) describe the operation of various backing store memory devices

Competence

The trainee should have the ability to:

i) Expand computer memory
ii) Use backing store memory

Content

19.2.3T1 Definition of terms in memory

19.2.3T2 Construction and operation of primary memory
- i) Random Access Memory (RAM)
- ii) Read Only Memory (ROM)

19.2.3T3 Computer memory organisation
- i) memory mapping
- ii) chip organisation

19.2.3T4 Description of various backing store memory devices
- i) Need for backing store
- ii) Magnetic tapes
- iii) Magnetic cassettes
- iv) Magnetic disc
- v) Hard disc
- vi) Floppy diskettes
- vii) Bubble memories
- viii) Charge Coupled Devices (CCD)
- ix) Compact Discs (CD)
- x) Digital Versatile Disc (DVD)
- xi) Flash disks

Practice

19.2.3P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) expand a computer memory
b) store and retrieve data in various backing store memory devices

Content

19.2.3P1 computer memory expansion
- RAM expansion

19.2.3P2 Storage and retrieval of data in various backing store memory devices

Suggested Assessment Methods

i) RAM memory chips
ii) Computer system
iii) Backing store memory devices

19.2.4 PROGRAMMING

Theory

19.2.4T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) write short programs on assembly language
b) hand code a given program to hexadecimal code

Competence
The trainee should have the ability to:
i) write programs in assembly language
ii) run programs in microprocessor systems

Content
19.2.4T1 Assembly language program
i) Data transfer
ii) Data manipulation
iii) Transfer of control
iv) Input/output instruction
v) Machine control
19.2.4T2 Hand coding
i) 8085 instruction set
ii) machine code

Practice

19.2.4P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) safety cable and power the microprocessor kit
b) enter a program in 8085 microprocessor kit
c) run a program in 8085 micro processor kit

Content
19.2.4P1 Setting up an 8085 microprocessor kit
19.2.4P2 Entering of a program into 8085 microprocessor kit
i) Address field
ii) Data field
iii) Hexadecimal keys
iv) Function keys
19.2.4P3 Running a program in 8085 micro processor kit
- Function keys

Suggested Learning Resources
i) Intel 8085 instruction set
ii) Intel 8085 microprocessor kit

20.2.0 RADIO SYSTEMS

20.2.1 Introduction

This module is designed to equip the trainee with the necessary knowledge, skills and attitude required to understand the principles of radio transmission and reception. Trainees undertaking this module unit require prior knowledge of electronics and micro electronics. Upon completion of the unit trainees will be able to maintain and repair radio equipment

20.2.2 General Objectives

By the end of this module unit, the trainee should be able to:

a) understand the concepts of radio systems
b) understand the use and application of radio systems
c) understand principles of wave propagation and antennas

20.2.3 Module Summary and Time Allocation

Radio Systems

Code	Module Unit	Content	Time Hrs		
			Th.	Pra.	Total
20.2.1	Amplitude Modulated	• Definition of AM • Principles of AM • Operation of AM modulators • Single sideband generation • Double sideband	10	12	22
20.2.2	Am Radio Receivers	• Operation of TRF • Operation of superhet radio receiver • Choice of local oscillator frequency • Interference • Choice of I.F. • Receiver parameters • Automatic gain control	16	24	40

		• Receiver circuits			
20.2.3	Frequency Modulates (FM) Radio Transmitters	• Definition of FM • Principles of FM • Generation of FM wave • Noise • Stereophonic FM multiplex	8	12	20
	FM Radio Receivers	• Operation of FM receiver • Operation of F.M. receiver circuits • Stereo F.M. multiplex • Automatic frequency control • Automatic gain control	4	6	10
20.2.5	Wave Propagation and Antennas	• Fundamentals of electromagnetic waves • Modes of radio wave propagation • Effects of the environment • Fading • Principles of antenna radiation • Operation of antennas • Terminologies	8	4	12
Total Time			**46**	**58**	**104**

20.2.1 AMPLITUDE MODULATED (AM) RADIOS TRAMSMITTERS

Theory

20.2.1T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
d) define amplitude modulation
e) explain principles of amplitude modulation
f) explain the operation of AM modulators
g) describe methods of single sideband generation
h) describe the double side band (DSB)

Competences
The trainee should have the ability to:
i) Measure AM radio transmitter parameters
ii) Maintain and repair AM radio transmitters

Content
20.2.1T1 Definition of amplitude modulation
20.2.1T2 Principles of amplitude modulation
i) AM theory
ii) Frequency spectrum
iii) Power relations in AM wave
iv) High and low level modulation
20.2.1T3 Operation of AM modulators
i) Transistor modulator
ii) Transistor balanced modulator
iii) Diode single balanced modulator
i) Cowan modulator
ii) Ring modulator
iii) Modulated class C amplifier
20.2.1T4 Single Side Band generation
i) Filter method
ii) Phase shift method
20.2.1T5 Double Side-Band

Practice

20.2.1P0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) measure AM radio parameters
b) maintain and repair AM radio transmitters

Content
20.2.1P1 Measurement of AM radio transmitter parameters

i) Carrier level
ii) Modulating signal level
iii) Modulation depth
iv) Carrier frequency
v) Modulating signal frequency
vi) Bandwidth

20.2.1P2 Maintenance and repair of AM radio transmitters
i) Carrier frequency generators
ii) Modulators
iii) Buffer amplifier
iv) Audio frequency amplifiers
v) Frequency synthesizers
vi) Power amplifiers
vii) Filter circuits
viii) Phase shifting networks
ix) Antennae coupling circuits

Suggested Learning Resources
i) AM radio transmitter training kit
ii) Modulated signal generators
iii) Cathode ray oscilloscope
iv) Spectrum/ wave Analyzers
v) Measuring instruments
vi) Power supply units
vii) Modulation meter

20.2.2 AMPLITUDE MODULATION (AM) RADIO RECEIVERS

Theory

20.2.2T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) describe the operation of a tuned radio frequency (T.R.F) radio receiver
b) describe the operation of a super heterodyne radio receiver
c) explain choice of local oscillator frequency
d) explain radio interference and their rejection
e) state factors to consider in choosing intermediate frequency
f) define receiver parameters
g) explain automatic gain control
h) explain the operation of selected receiver circuits

Competencies
The trainee should have the ability to:

i) Measure AM radio receiver parameters
ii) Repair of AM radio receivers

Content

20.2.2T1 Operation of T.R.F
i) Antennae
ii) R.F amplifier
iii) Loudspeaker

20.2.2T2 Operation of super heterodyne radio receiver
i) Antennae
ii) R.F receiver
iii) Mixer
iv) Local oscillator
v) R.F amplifier
vi) Detector
vii) A.F amplifier
viii) Loud speaker

20.2.2T3 Choice of local oscillator frequency

20.2.2T4 Interference and their rejection
i) Image signal
ii) Co channel
iii) Local oscillator radiation
iv) I.F trap

20.2.2T5 Choice of intermediate frequency
i) I.F bandwidth
ii) Interference signals
iii) I.F gain and stability
iv) Adjacent channel (selectivity)

20.2.2T6 Definition of receiver parameters
i) Sensitivity
ii) Selectivity
iii) Double splitting
iv) Adjacent channel ratio

20.2.2T7 Automatic gain control (A.G.C)
i) No A.G C
ii) Delayed A.G.C
iii) Simple A.G.C
iv) Ideal A.G.C

20.2.2T8 Operation of receiver circuits
i) Separately excited mixer
ii) Self excited mixer
iii) Diode detector
iv) Muting (squelch)

Practice

20.2.2P0 *Specific objectives*
By the end of the sub module unit, the trainee should be able to:
a) measure AM radio receiver parameters
b) identify fault symptoms
c) carry out static and dynamic test on AM radio receiver
d) repair AM radio receivers

Content

20.2.2P1 Measurement of AM radio receiver parameters
i) Sensitivity
ii) Selectivity
iii) Interference
iv) Gain
v) Output power

20.2.2P2 Fault symptoms
i) No output

ii) Motor boating
iii) Dead receiver
iv) Weak output signal
v) Intermittent operation
vi) Wobbling output
vii) Hissing noise
viii) Two stations picked at the same dial setting
ix) Noisy output
x) Fading

20.2.2P3 Tests
i) Static
ii) Dynamic

20.2.2P4 Repair of AM radio receivers
i) Fault detection
ii) Fault location
iii) Fault repair
iv) Final tests

Suggested Learning Resources
i) CRO
ii) AM radio receiver training kit
iii) Multimeters
iv) Bench power supply
v) Modulated signal generators
vi) Standard electronic toolkit
vii) Components

20.2.3 FREQUENCY MODULATED (FM) RADIO TRANSMITTER

Theory

20.2.3T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) define frequency modulation
b) explain the principles of frequency modulation
c) describe methods of generating FM wave
d) state the effects of noise on an FM wave
e) explain stereophonic FM multiplexing

Competences
The trainee should have the ability to:
i) Measure FM radio parameters
ii) Maintain and repair FM radio transmitters

Content
20.2.3T1 Definition of frequency modulation
20.2.1T2 Principles of frequency modulation
-FM theory
20.2.3T3 Generation of FM wave
i) Transistor reactance modulator
ii) Automatic Frequency Control
iii) Varacter diode modulator
iv) AFC system (block diagram)

v) Armstrong systems (block diagram)

20.2.3T4 Noise

vi) Cochannel interference
vii) Capture effect
viii) Noise on carrier

20.2.3T5 Stereophonic FM multiplex

Practice

20.2.3P0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to:

a) measure FM parameters
b) maintain and repair FM transmitters

Content

20.2.3P1 Measurement of FM parameters

i) Carrier level
ii) Carrier frequency
iii) Modulating signal frequency
iv) Deviation
v) Modulation index
vi) Bandwidth

20.2.3P2 Maintenance and repair

i) Carrier frequency generators
ii) Modulators
iii) Buffer amplifier
iv) Audio frequency amplifiers
v) Frequency multipliers
vi) Discriminator
vii) Power amplifiers
viii) Antennae coupling circuits

Suggested Learning Resources:

i) FM transmitter training kits
ii) Modulated signal generators
iii) Cathode Ray Oscilloscope
iv) Spectrum/wave analyzers
v) Multimeters
vi) Bench power supplies

20.2.4 FREQUENCY MODULATED (FM) RADIO RECEIVERS

Theory

20.2.4T0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to:

a) describe the operation of FM receiver
b) explain the operation of receiver circuits
c) explain the operation of FM multiplex reception
d) explain automatic frequency control (AFC)
e) explain automatic gain control (AGC)

Competence

The trainee should have the The trainee should have the ability to::

i) Measure FM receiver parameters
ii) Repair FM radio receivers

Content

20.2.4T1 Operation of FM receiver
- i) Block diagram
- ii) r.f amplifier
- iii) mixer
- iv) local oscillator
- v) i.f amplifier
- vi) discriminator
- vii) de – emphasis network
- viii) a.f and power amplifiers
- ix) loudspeakers

20.2.4T2 Operation of receiver circuits
- i) amplitude limiter
- ii) slope detector
- iii) phase discriminator
- iv) ratio detector

20.2.4T3 Stereo FM multiplex
- block diagrams

20.2.4T4 Automatic frequency control (AFC)

20.2.4T5 Automatic gain control (AGC)

Practice

20.2.4P0 *Specific Objectives*

By the end of the unit, the trainee should be able to:

a) measure FM radio parameters
b) identify receive fault symptoms
c) carry out static and dynamic test
d) repair FM radio receivers

Content

20.2.4P1 Measurement of FM radio receiver parameters
- i) Gain
- ii) Power output
- iii) Deviation (frequency drift)
- iv) Selectivity
- v) Distortion

20.2.4P2 Fault symptoms
- i) Dead receiver
- ii) Frequency drifts
- iii) Motor boating
- iv) No output
- v) Weak output
- vi) Intermittent operation
- vii) Hissing noise
- viii) Wobbling output
- ix) Noisy output
- x) Fading

20.2.4P3 Static and dynamic tests

20.2.4P4 Repair of FM radio receivers
- i) Fault detection
- ii) Fault location
- iii) Fault repair
- iv) Final tests

Suggested Learning Resources:

i) FM radio receiver training kit
ii) Distortion meters
iii) Cathode Ray Oscilloscope
iv) Multimeters
v) Standard electronic kit
vi) Bench power supply
vii) Modulated signal generators
viii) Audio signal generators
ix) Deviation meters

20.2.5 WAVE PROPAGATION AND ANTENNAS

Theory

20.2.5T0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to:

a) explain fundamentals of electromagnetic waves
b) describe modes of radio wave propagation
c) state the effects of the environment on radio waves
d) describe fading
e) explain principles of antenna radiation
f) describe the operation of various types of antennas
g) define various terminologies applied to wave propagation

Competencies

The trainee should have the ability to construct and install an aerial

Content

20.2.5TI Fundamentals of electromagnetic waves
i) Electric field
ii) Magnetic field
iii) Direction of propagation
iv) Free space

20.2.5T2 Modes of radio wave propagation
i) Ground waves
ii) Sky waves

20.2.5T3 Effects of the environment
i) Reflection
ii) Refraction
iii) Interference
iv) Diffraction

20.2.5T4 Fading
i) General fading
ii) Selective fading

20.2.5T5 Principles of antenna radiation
i) Closed loops of magnetic flux
ii) Closed loops of electric flux
iii) Electromagnetic wave

iv) Polarization
v) Induction field
vi) Dipole

20.2.5T6 Operation of various types of antennas
i) rod aerial
ii) loop aerial
iii) whip aerial
iv) broadside array
v) end-fire array
vi) folded dipole
vii) yagi uda
viii) rhobic
ix) radiation patterns

20.2.5T7 Terminologies
i) Wave propagation
- critical frequency
- maximum usable frequency
- skip distance
- multi-hop transmission
- virtual height
- ducts

ii) Antennas
- directive
- radiation resistance
- beamwidth
- polarization
- front-to-back ratio
- gain

Practice

20.2.5P0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) construct an aerial
b) install an aerial

Content

20.2.5P1 Construction of aerials
i) Reflector
ii) Dipole
iii) Directors

20.2.5P2 Installation of aerials
i) Aerial coupling
ii) Directivity

Suggested Learning Resources
i) Aluminum rods
ii) Receiver (TV/Radio)
iii) Screws
iv) Coaxial cable
v) Twin wire
vi) Aluminum plate
vii) Drilling and cutting tools

21.2.0 TELEVISION FUNDAMENTALS

21.2.01 INTRODUCTION

This module is designed to equip the trainee with the necessary knowledge, skills and attitudes required to understand the principles of television transmitters and receivers. Trainees undertaking this module unit require prior training in basic electronics. Upon completion of this unit, the trainees should be able to install service and maintain TV transmitters and receiver circuits.

21.2.02 GENERAL OBJECTIVES

By the end of the module, the trainee should be able to:

a) understand the principles of tv transmission and reception
b) understand the use and application of television.
c) observe safety while working with tv transmitters and receivers

21.2.03 MODULE SUMMARY AND TIME ALLOCATION

TELEVISION (TV) FUNDAMENTALS

CODE	Sub Module Unit	Content	Time hrs		
			Th.	Pra.	Total
21.2.1	T.V. Transmitters	• Block diagram • Types of T.V. cameras • Principles of T.V. transmission	12	12	24
21.2.2	T.V. Receiver	• Block diagram • Television reception • T.V. circuits	10	14	24
21.2.3	Colour T.V. Receiver	• Functions of block diagram • Colour reception	6	23	29
Total Time			**28**	**49**	**77**

21.2.6.0 TV TRANSMITTERS

Theory

21.2.1T0 *Specific Objective*
By the end of the sub module unit, the trainee should be able to
a) explain the function of each block of a TV transmitter
b) state the types of television cameras
c) explain the principles of television transmission

Competence
The trainee should have the ability to:
i) Maintain and repair TV transmitters

Content
21.2.1T1 Basic block diagram
i) Camera tube
ii) Scanning and synchronizing circuits
iii) Video amplifier
iv) Picture signal transmitter
v) Audio amplifier
vi) Sound signal transmitter
vii) Transmitting antenna

21.2.1T2 Types of TV cameras
i) Vidicon
ii) Plumbicon
iii) Caticon
iv) Cilicon vidicon
v) Chalnicon
vi) Newvicon

21.2.1T3 Principles of TV transmission
i) negative transmission
ii) vestigial sideband transmission
iii) amplitude modulation
iv) single-sideband transmission
v) frequent modulated (FM) sound signal
vi) pre-emphasis
vii) satellite television

Practice

21.2.1P0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to
a) identify parts of a TV transmitter
b) measure various parameters of a TV transmitter
c) maintain and repair TV transmitters

Content
21.2.1P1 Parts of TV transmitter
i) Camera tube
ii) Scanning and signs circuits
iii) Video amplifier
iv) Picture signal transmitter
v) Audio amplifier
vi) Sound signal transmitter
vii) Transmitting antenna

21.2.1P2 Parameters of a TV transmitter
- i) Carrier level
- ii) Modulation depth
- iii) Frequency spectrum
- iv) Sound signal level

21.2.1P3 Maintenance and repair
- i) Fault symptoms
- ii) Tests to locate fault
- iii) Fault repair
- iv) Final tests

Suggest Learning Resources
- i) TV transmitter trainer kits
- ii) Cathode ray oscilloscope
- iii) Multimeter
- iv) Manuals
- v) Spectrum analyzer
- vi) RF power meter

21.2.2 TV RECEIVERS

Theory

21.2.2T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to
- a) explain the functions of various components of a TV receiver block diagram
- b) explain the principles of television reception
- c) describe the operation of various TV receiver circuits

Competence
The trainee should have the ability to diagnose and repair TV receivers

Content

21.2.2T1 Block diagram of a TV receiver
- i) Receiving antenna
- ii) RF amplifier
- iii) Mixer
- iv) Local oscillator
- v) Picture IF amplifier
- vi) Video detector
- vii) Video amplifier
- viii) Sound detector
- ix) Audio amplifiers
- x) Sound detector
- xi) Audio amplifiers
- xii) Sync separator
- xiii) Vertical and Horizontal deflection circuits
- xiv) HV rectifier
- xv) Picture tube
- xvi) Loudspeaker

21.2.2T2 Television reception
- i) Picture elements
- ii) Horizontal and vertical scanning
- iii) Frame
- iv) Video signal formation
- v) Motion picture
- vi) Frame and field frequencies
- vii) Synchronization
- viii) Blanking
- ix) Interlaced scanning
- x) Picture qualities

21.2.2T3 TV circuits

i) Video detector
ii) Video amplifier
iii) Automatic gain control
iv) Sync separator
v) Vertical deflection oscillator
vi) Horizontal deflection oscillator
vii) Voltage multiplier
viii) HV rectifier
ix) TV picture tube (CRT)

Practice

21.2.2P0 *Specific Objectives*
By the end of the sub module unit, the train should be able to:
a) identify parts of a TV receiver
b) identify types of signals in a TV receiver
c) diagnose and repair TV receivers

Content

21.2.2P1 Parts of a TV receiver
i) As listed in the content of TV receiver theory

21.2.2P2 Signal levels and waveforms
i) Composite video signal
ii) Picture IF signal frequency
iii) Sound IF signal frequency
iv) Sound signal waveform
v) Video detector output waveform
vi) Vertical deflection oscillator output waveform
vii) Horizontal deflection oscillators output waveform
viii) Power supply voltage

21.2.2P3 Fault diagnosis and repair
i) No picture, no sound, no raster
ii) No picture, no sound, raster present
iii) No sound, picture present
iv) Picture present, no sync, sound present
v) No field scan but sound present
vi) No picture, no raster but sound present
vii) Distorted field scan
viii) Vertical bright line on screen
ix) Horizontal bright line on screen
x) Brilliant rater
xi) Blurred picture
xii) Field flyback lines showing
xiii) Sound on picture
xiv) Poor picture definition
xv) Trapezium shaped scan
xvi) Uncontrolled and excessive contrast

xvii) Excessive noise
xviii) Human bends/bars
xix) Black borders on raster
xx) Blooming

Suggested Learning Resources

i) TV receiver trainer kit
ii) Cathode ray oscilloscope
iii) Multimeters
iv) Manuals
v) DC power supply
vi) Connecting leads
vii) Standard electronic toolkit
viii) HV meter
ix) Tuner subber

21.2.3 COLOUR TV RECEIVER

Theory

21.2.3T0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to:

a) state the function of block diagram of colour circuits
b) explain principles of colour reception

Competence

The trainee should have the ability to:

i) Test colour TV receivers
ii) Diagnose and repair colour TV receivers

Content

21.2.3T1 Functions of block diagram

i) Chroma detector
ii) Chroma bandpass amplifier
iii) Chroma amplifier
iv) Colour demodulator
v) Colour killer
vi) Colour adders
vii) Colour guns
viii) Colour picture tube

21.2.3T2 Colour reception

i) Primary colours
ii) Colour addition
iii) Decoding the picture information
iv) Colour demodulation
v) Colour mixing
vi) Colour picture qualities
vii) Colour emphasis

Practice

21.2.3P0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to:

a) identify parts of the colour TV
b) diagnose and repair colour TV

Content

21.2.3P1 Colour TV circuits

i) Chroma detector

ii) Chroma bandpass amplifier
iii) Chroma amplifier
iv) Colour demodulator
v) Colour killer
vi) Colour burst
vii) Colour adders
viii) Colour guns
ix) Colour picture tube

21.2.3P2 Diagnosis and repair
i) No colour balance
ii) Cyan black image
iii) Picture appears magenta
iv) Picture appears green
v) No brightness and no raster
vi) No luminance signal
vii) No colour, weak colour or too much colour
viii) Change in white balance
ix) Colour bars drifting through the picture

Suggested Teaching/Learning Resources
i) Colour TV trainer kit
ii) Cathode ray oscilloscope
iii) Colour bar generator
iv) Manuals
v) Multimeter
vi) Standard electronic tool kit
vii) HV meter
viii) Tuner subber

22.2.0 DATA COMMUNICATION

22.2.01 Introduction

This module is designed to equip the trainee with the necessary knowledge, skills and attitudes required to understand the principles of data communications. Trainees require prior knowledge of micro electronics to enhance their understanding of the content of this module.

22.2.02 General Objectives

By the end of the module, the trainee should be able to:

a) understand the concepts of data communication
b) apply different transmission media in data communication
c) understand various coding schemes
d) apply various data transmission media
e) apply various digital modulations techniques
f) appreciate the need for international standards in data communication
g) appreciate the concept of open system interconnects on model

22.2.03 Module Summary and Time Allocation

Data Communication

Code	Unit	Sub Unit	Time Hrs		
			Th.	Pra.	Total
22.2.1	Communication Fundamentals	• Definition of terms • Definition between transmission • Basic data communication network • Transmission impairment	4	4	8
22.2.2	Signal Encoding and Modulation Techniques	• Encoding schemes • Digital to analog signal encoding • PCM • Multiplexing schemes	6	6	12
22.2.3	Switching Systems	• Principles of circuit switching • OSI model	2	6	8
22.2.4	Data Transmission Media	• Guided transmission media • Wireless transmission media • Standards media	4	8	12
22.2.5	Computer Networking	• Terminologies • LAN architecture • Medium access and control protocols	8	4	12
22.2.6	Mobile Phone	• Construction • Operation	6	8	14
Total Time			**30**	**36**	**66**

22.2.1 COMMUNICATION FUNDAMENTALS

Theory

22.2.1T0 *Specific objectives*
By the end of the sub module unit, the trainee should be able to:
a) define terms applied to data communication
b) distinguish between series and parallel transmission
c) describe the basics of a data communication network
d) explain types of transmission impairment

Competence
The trainee should have the ability to connect and repair transmission systems

Content

22.2.1T1 Definition of terms
i) Data
ii) Information
iii) Receiver
iv) Signal
v) Data Terminal Equipment (DTE)
vi) Data Circuit Terminating Equipment (DCTE)
vii) Simplex
viii) Half duplex
ix) Full duplex
x) Frequency
xi) Bandwitdth

22.2.1. T3 Distinction between transmission
i) Parallel
ii) Serial

22.2.1. T4 Basic data communication network
i) Point to point
ii) Multi point
iii) Distributed

22.2.1. T5 Transmission impairment
i) Noise
ii) Distortion
iii) Attention
iv) Sitters
v) Information theory concepts
vi) Information measurements
vii) Source coding
viii) Construction of optical codes
ix) Transmission rate
x) Channel capacity

Practice

22.2.1P0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) Connect various transmission net work
b) Detect and rectify transmission impairment

Content

22.2.1P1 Transmission net work
- i) Simplex
- ii) Half duplex
- iii) Full duplex
- iv) Serial
- v) Parallel

22.2.1. P2 Transmission impairment

Suggested Teaching/ Learning
- i) Electrical and electronic measuring instruments
- ii) Data transmission equipment and devices
- iii) Switching circuits
- iv) Accessories

22.2.2 SIGNAL ENCODING AND MODULATION TECHNIQUES

Theory

22.2.2T0 *Specific objectives*
By the end of the unit, the trainee should be able to:
- a) explain digital to digital signal encoding schemes
- b) explain digital to analogue encoding schemes
- c) explain data multiplexing schemes

Competence
The trainee should have the ability to:
- i) Perform signal encoding
- ii) Connect multiplexing schemes

Content

22.2.2T1 Digital to digital signal encoding schemes
- i) Polar codes
- ii) Bipolar codes
- iii) Applications

22.2.2T2 Digital to analogue signal encoding scheme

22.2.2T3 Multiplexing schemes

Practice

22.2.2P0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
- c) demonstrate digital to digital signal encoding
- d) demonstrate digital to analogue signal encoding
- e) connect multiplexing schemes

Content

22.2.2P1 Digital to digital encoding
- i) Polar codes
- ii) Bipolar codes

22.2.2P2 Digital to analogue signal encoding

22.2.2P3 Multiplexing schemes

Suggested Teaching/ Learning

i) Electrical and electronic measuring instruments
ii) Data transmission circuits

22.2.3 SWITCHING SYSTEMS

Theory

22.2.3T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) state the principles of circuit switching
b) explain the OSI model

Competence
The trainee should have the ability to connect switching

Content
22.2.3 T1 Principles of circuit switching
i) Digital data switching
ii) Digital PABX
iii) Broadband Integrated (BSDN)
iv) Service digital network
v) PSTN (Public Switching Telephone Network)
22.2.3 T2 Explanation of the OSI (Open System Interconnection) model
i) Layneation model
ii) Interconnection
iii) Physical (OSI layer)
iv) Data link
v) Network
vi) Transport
vii) Session
viii) Presentation
ix) Application

Practice

22.2.3P0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) demonstrate circuit switching
b) illustrate OSI layers

Content
22.2.3P1 Circuit switching
i) Switching
ii) Digital data switching
iii) Digital PABX
iv) Broad basic integrated
v) In-service digital network
vi) Public Switched Telephone Network (PSTN)
22.2.3P2 Open system interconnection (OSI)
i) Physical
ii) Data link
iii) Network
iv) Transport
v) Session
vi) Presentation
vii) Application

Suggested Teaching/ Learning

i) Switching circuits
ii) Electrical and Electronic Measuring instruments

22.2. 4 DATA TRANSMISSION MEDIA

22.2.4T0 *Specific Objectives*

By the end of the unit, the trainee should be able to:

a) explain various types of guided transmission media
b) explain various types of wireless transmission media
c) state standards with respect to guided and unguided media

Competence

The trainee should have the ability to:

i) Perform signal encoding
ii) Connect multiplexing schemes

Content

22.2.4T1 Guided transmission media
- i) Twisted pair media
- ii) Coaxial cable
- iii) Fibre optics

22.2.4T2 Wireless transmission media
- i) Terrestrial microwave
- ii) Satellite microwave
- iii) Broadcast radio
- iv) Infrared
- v) switching systems

22.2.4T3 Standards for guided and unguided media

Practice

22.2.4P0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to:

a) illustrate the various types of guided media
b) demonstrate various types of wireless transmission media

Content

22.2.4P1 Guided transmission media
- i) Twisted pair wire
- ii) Coaxial cable

22.2.4P2 Wireless transmission media
- i) Terrestrial microwave
- ii) Satellite microwave
- iii) Broadcast radio
- iv) Infrared

Suggested Teaching/ Learning

i) Electrical and electronic measuring instruments
ii) Data transmission circuits

22.2.5 COMPUTER NETWORKING

Theory

22.2.5T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) define various terminology applied to networking
b) describe LAN architecture and applications
c) explain media access control protocols

Content
22.2.5T1 Terminologies
i) LAN
ii) MAN
iii) WAN
22.2.5T2 LAN architecture
i) Applications
ii) Topologies
iii) Fast Ethernet
iv) Gigabit Ethernet
v) Token Ring
22.2.5T3 Explanation of medium access control protocols
i) Description of LAN devices
- Hubs
- Multi-station access units (MSAU)
- Repeaters
- Switches
- Bridges
ii) Virtual LANs
- Blue tooth architecture and layers

Practice

22.2.5P0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) select correct apparatus/equipment and cable sizes for a given computer network task
b) safely wire computer network space
c) network computer in a LAN
d) maintain a LAN computer network

Content
22.2.5P1 Selection of material requirement
i) apparatus/equipment
ii) cable sizes
22.2.5P2 Space wiring
22.2.5P3 Computer networking operation
i) Proper layout
ii) Connections
iii) Software installation
22.2.5P4 Maintenance
i) Hardware
ii) Software

Suggested Learning Resources
i) Network cables and connectors

ii) Networking equipment eg hubs
iii) Computers
iv) Test instruments
v) Trunking trays and covers

22.2.6 MOBILE PHONE

Theory

22.2.6T0 *Specific Objectives*
By the end of this unit, the trainee should be able to:
a) draw the functional block diagram of a mobile phone
b) state function(s) of each block

Competence
The trainee should have the ability to:
i) Network computers (LAN)
ii) Maintain computer network

Competence
The trainee should have the ability to repair and service mobile phones

Content
22.2.6. T1 Block diagram
22.2.6. T2 Functions of each block

Practice

22.2.6. P0 *Specific Objectives*
By the end of the unit, the trainee should be able to:
a) identify parts of a mobile phone
b) diagnose faults in mobile phones
c) repair mobile phones

Content
22.2.6. T1 Parts of a mobile phone
i) Central processing unit (CPU)
ii) Power IC
iii) Antenna
iv) SIM card connector
v) Key board
vi) Power amplifier IC
vii) Radio frequency (RF) processor
viii) Directional coupler
ix) Memory IC
x) Charge control module
22.2.6. T2 Fault diagnoses
i) Use of fault diagnostic kits
ii) Computer applications
iii) Tests
22.2.6. T3 Repair of mobile phones
i) Fault analysis
ii) Fault repair
iii) Replacement of parts
iv) Soldering
v) Assembly

Suggesting Teaching and Learning Resources
i) Assorted mobile phones

ii) Test instruments
iii) Toolkit
iv) Catalogs
v) Circuit/schematic diagrams
vi) Internet

23.2.0 INSTRUMENTS AND ELECTRONIC FAULT DI AGNOSIS

23.2.01 Introduction

This module it is designed to equip the trainee with knowledge, skills, attitudes and competencies necessary to provide maintenance service of electrical/electronic devices.

23.2.02 General Objectives

By the end of the module unit, the trainee should be able to;

a) Acquire skills to repair electrical and electronic equipment
b) Perform tests and diagnosis of electrical and electronic equipment
c) Appreciate the value of maintenance culture in electrical and electronic trade
d) Observe safety in electrical and electronic engineering work places

23.2.03 Module Unit Summary and Time Allocation

Instruments and Electronic Fault Diagnosis

Code	Sub module unit	Content	Time Hrs		
			Th.	Pra.	Total
23.2.1	Test Instruments	• Types of test instruments • Methods of measurement techniques	10	12	22
23.2.2	Test Signals	• Types of test signals and their characteristics • specifications of signal sources • Test signals in fault diagnosis performance tests	14	16	30
23.2.3	Maintenance and Service	• Types of maintenance • Correct procedure of maintenance and servicing • Maintenance aids • Faults in electrical and electronic systems	12	24	36

		• Repair techniques of typical faults of electrical and electronic systems			
Total Time			**36**	**52**	**88**

23.2.1 TEST INSTRUMENTS

Theory

23.2.1T0 *Specific objectives*

By the end of the sub-module unit, the trainee should be able to:

a) describe various types of test instruments
b) explain the methods measurement techniques

Competence

The trainee should have the ability to use measuring and test instruments correctly in the electrical and electronic laboratory and other work places

Content

23.2.1T1 Types of test instruments
- i) Multimeter (analogue and digital)
- ii) Cathode Ray Oscilloscope (CRO)
- iii) Spectrum analyzer
- iv) wave analyzer

23.2.1T2 Methods of measurement
- i) Connection of equipment to circuit
- ii) Taking reading

Practice

23.2.1P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) demonstrate safety in using various test instruments
b) calibrate measuring instruments before use
c) connect measuring and test instruments correctly in given electronic systems

Content

23.2.1P1 Safety
- i) low voltages equipment
- ii) high voltage equipment

23.2.1P2 Calibration of instruments
- i) CRO
- ii) signal generator

23.2.1P3 Connection of instruments
- i) signal injector
- ii) signal generator

Suggested Learning Resources
- i) Calibrating instruments
- ii) Instrument manual
- iii) Cathode ray oscilloscope

23.2.2 TEST SIGNALS

Theory

23.2.2T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) identify types of test signals and their characteristics
b) state specification of signal sources
c) apply various test signals in fault diagnosis and performance tests

Competence

The trainee should have the ability to: correct faults in various electronic systems using test signals

Content

23.2.2T1 Types and characteristics of test signals
- i) Types
- ii) sine squared pulse and bar
- iii) stair case wave form
- iv) modulated signals
- v) pulse signals
- vi) triangular wave
- vii) square wave
- viii) sine wave
- ix) Characteristics
- x) duration
- xi) bandwidth
- xii) frequency
- xiii) rise time and fall time
- xiv) amplitude

23.2.2T2 Specification of signal sources
- i) Attenuation and gain db
- ii) Output impedance
- iii) Stability
- iv) Accuracy

23.2.2T3 Application of test signals
- i) Fault diagnosis:
- ii) Injection of test signals at relevant joints
- iii) interpretation of test results

Practice

23.2.2P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) safely connect equipment to display test signals on electronic systems
b) safely inject test signals on electronic systems
c) interpret displayed test signals at various joints

Content

23.2.2P1 Connection of testing equipment to display test
- i) signals
- ii) sine wave
- iii) square wave
- iv) triangular wave
- v) pulse signals

vi) modulated signals
vii) staircase wave
viii) sine square pulse and bar

23.2.2P2 Injection (insertion) of test signals

23.2.2P3 Interpretation of displayed test signals at various
i) Joints
ii) Determination of signal characteristics
iii) Duration
iv) Band width
v) Frequency
vi) Rise / fall time
vii) Amplitude

Suggested Learning Resources
i) signal modulators
ii) CRO
iii) Electronic equipment
iv) signal injectors
v) maintenance circuit diagrams
vi) power supplies
vii) connecting cables and wires

23.2.3 MAINTENANCE AND SERVICE

Theory

23.2.3T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) explain the terms maintenance and service
b) explain types of maintenance
c) describe correct procedures of maintenance and servicing
d) select appropriate maintenance aids
e) explain repair techniques of faults in electronic systems

Competence
The trainee should have the ability to:
i) maintain and service electrical/electronic systems
ii) diagnose typical faults on electrical/electronic equipments and remedies

Content

23.2.3T1 Definition of terms
i) Maintenance
ii) Service
iii) The need for maintenance and service

23.2.3T2 Types of maintenance
i) Preventive
ii) Routine
iii) Corrective

23.2.3T3 Procedure for maintenance and service
i) Problem analyses
ii) Selection of appropriate methods

iii) Acquisition of necessary aids
iv) Systematic problem solution
v) Final testing

23.2.3T4 Selection of appropriate maintenance aids
i) tools
ii) manuals
iii) test equipment
iv) spares(components)

23.2.3T7 Repairing techniques of faults in electronic systems

Practice

23.2.3P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) safely carry out preventive and corrective maintenance on electronic systems
b) safely demonstrate correct procedures of maintenance and servicing
c) maintain and service other electronic systems and equipments
d) safely repair typical faults on electronic equipments
e) safely perform functional and safely tests on electrical/electronic equipments

Contents

23.2.3P1 Preventive and corrective maintenance
i) Electronic systems
ii) video recorder
iii) digital clock
iv) tape recorder
v) computer system
vi) DVD / VCD player
vii) Office equipment
viii) Domestic electrical/electronic

23.2.3P2 Correct procedures of maintenance and servicing of electrical/electronic systems

23.2.3P3 Maintenance and servicing on electrical/electronic systems

23.2.3P5 Repair of typical faults on electrical/electronic systems

23.2.3P6 Functional and safety tests on electrical/electronic equipment

Suggested Learning Resources
i) Electronic systems
ii) Signal generators
iii) Circuit diagrams
iv) Functional generators
v) Tools

24.2.0 BUSINESS PLAN

24.2.01 Introduction

This module unit is designed to equip the trainee with knowledge, skills and attitudes to enable him/her prepare a business plan.

24.2.02 General Objectives

By the end of this module unit, the trainee should be able to:

a) understand the background of intended business
b) understand the market environment of the business
c) understand organization and management plan
d) appreciate operational plan
e) prepare financial projections
f) prepare a business plan

24.2.3 Module Unit Summary and Time Allocation

Business Plan

Code	Sub Module Unit	Content	Time Hrs
24.2.1	Introduction To Business Planning	• Meaning of business plan • Purpose of a business plan • Features of a business plan • Guidelines for developing an effective business plan	4
24.2.2	Business Description	• Business name • Business location and address • Form of business ownership • Type of business • Products/ services • Justification of the opportunity • The industry • Business goals and objectives • Entry and growth strategy • SWOT analysis	4
24.2.3	Marketing Plan	• Customer identification • Competitor analysis • Market share • Promotion and advertising	4

		• Pricing strategy • Sales tactics • Sales target • Distribution strategy • Customer service	
24.2.4	Organization And Management Plan	• Organization structure • Management team • Recruitment, training and promotion • Remuneration and incentives • Licenses, permits and other requirements • Supporting services	4
24.2.5	Operational/ Production Plan	• Production facilities and capacity utilization • Production and operation strategy • Production process • Regulations affecting operations • Operational time table/production schedule •	4
24.2.6	Financial Plan	• Pre-operations cost • Working capital • Cash flow projections • Pro-forma income statements • Pro-forma balance sheets • Break even analysis • Profitability rations • Desired financing • Proposed capitalization • Potential risks	4
24.2.7	Presentation	• Business plan writing • Presentation of the business plan	16
24.2.8	Emerging Trends	• Emerging issues in business planning • Strategies in dealing with emerging issues	4
Total time			**44**

24.2.1 INTRODUCTION

Theory

24.2.1T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) explain the meaning of a business plan
b) explain the purposes of a business plan
c) identify the features of a business plan
d) describe guidelines for developing an effective business plan

Content
24.2.1T 1 Meaning of a business plan
24.2.1T 2 Purposes of a business plan
24.2.1T 3 Features of a business plan
24.2.1T 4 Guidelines for developing an effective business plan

Practice

24.2.1P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to;
a) identify the features of a business plan
b) describe guidelines for developing an effective business plan

Content
24.2.1P1 Features of a business plan
24.2.1P2 Guidelines for developing an effective business plan

24.2.2 BUSINESS DESCRIPTION

Theory

24.2.2T1 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to;
a) provide the business name
b) describe business location and address
c) discuss form of business ownership
d) explain the type of business
e) describe the products offered
f) discuss the justification of opportunity
g) describe the industry
h) explain the goals of business
i) explain the entry and growth strategy
j) discuss SWOT analysis

Content
24.2.2T1 Provide the business name

24.2.2T2 Business location and address
24.2.2T3 Form of business ownership
24.2.2T4 Type of business
24.2.2T5 Products offered
24.2.2T6 Justification of opportunity
24.2.2T7 The industry
24.2.2T8 The goals of business
24.2.2T9 Entry and growth strategy
24.2.2T10 SWOT analysis

Practice

24.2.2P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) develop business names
b) discuss form of business ownership
c) explain the type of business
d) describe the products offered

Content

24.2.3T1 Create a business name
24.2.3T 2 Form of business ownership
24.2.3T 3 Type of business
24.2.3T 4 description of products offered

24.2.3 MARKETING PLAN

Theory

24.2.3T0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to:

a) identify customers
b) describe the competitors
c) determine the market share
d) explain the methods of promotion and advertising
e) explain the pricing strategy
f) set sales target
g) describe the sales tactics
h) describe the distribution strategy
i) describe the customer service strategy

Content

24.2.3T1 Identification of customers
24.2.3T2 Competitors analysis
24.2.3T3 Determination the market share
24.2.3T4 Methods of promotion and advertising
24.2.3T5 Pricing strategy
24.2.3T6 Set sales target
24.2.3T7 Sales tactics
24.2.3T8 Distribution strategy
24.2.3T9 Customer service strategy

Practice

24.2.3P0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to;

a) identify customers
b) describe the competitors
c) determine the methods of promotion and advertising
d) explain the factors to consider in pricing
e) identify the sales tactics
f) describe the distribution strategy
g) describe the customer service strategy

Content

24.2.3P1 Identification of customers
24.2.3P2 Competitors analysis
24.2.3P3 Methods of promotion and advertising
24.2.3P4 Pricing strategy
24.2.3P5 Sales tactics
24.2.3P6 Distribution strategy
24.2.3P7 Customer service strategy

24.2.4 ORGANIZATION AND MANAGEMENT PLAN

Theory

24.2.4T1 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) describe the organization structure
b) describe the management team
c) identify other business personnel
d) explain recruitment, training and promotion of personnel
e) discuss remuneration and incentives for personnel
f) identify licenses persist and legal requirements
g) identify support services

Content

24.2.4T 1 Organization structure
24.2.4T 2 Management team
24.2.4T 3 Other business personnel
24.2.4T 4 Recruitment, training and promotion of personnel
24.2.4T 5 Remuneration and incentives for personnel
24.2.4T 6 Licenses persist and legal requirements
24.2.4T 7 Support services

Practice

24.2.4P1 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) draw organization structure
b) assemble a the management team
c) develop a management plan

Content

24.2.4P1 Organization structure
24.2.4P2 Management team
24.2.4P3 Management plan

24.2.5 OPERATIONAL AND PRODUCTION PLAN

Theory

24.2.5T0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:

a) identify production facilities and capacity
b) develop a production and operation strategy
c) describe the production process of the products
d) discuss the regulations affecting operations
e) prepare operation time table/production schedule

Content

24.2.5T 1 Production facilities and capacity
24.2.5T 2 Develop a production and operation strategy
P24.2.5T3 Production process of the products
24.2.5T 4 Production processes of the products
24.2.5T 5 Regulations affecting operations
24.2.5T 6 Prepare operation time table/production schedule

Practice

24.2.5P0 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:

a) identify production facilities and capacity
b) describe the production process of the products

Content

24.2.5P 1 Production facilities and capacity
24.2.5P 2 Production processes of the products

24.2.6 FINANCIAL PLAN

Theory

24.2.6T1 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to;

a) determine pre-operational costs
b) estimate working capital
c) estimate cash-flow projections
d) prepare pro-forma income statements
e) prepare pro-forma balance sheets
f) calculate break-even point
g) calculate profitability rations
h) calculate desired financing
i) calculate proposed capitalization
j) identify potential

Content

24.2.6T 1 Determination aspect of a financial plan
24.2.6T 2 Estimating working capital
24.2.6T 3 Estimating cash-flow projections
24.2.6T 4 Preparation pro-forma income statements
24.2.6T 5 Preparation pro-forma balance sheets
24.2.6T 6 Calculation break-even point
24.2.6T 7 Calculation profitability rations

Practice

24.2.6P1 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to;

a) determine pre-operational costs
b) estimate working capital
c) estimate cash-flow projections
d) prepare pro-forma income statements
e) prepare pro-forma balance sheets
f) calculate break-even point
g) calculate profitability rations

Content

24.2.6P1 Determination pre-operational costs
24.2.6P2 Estimating working capital
24.2.6P3 Estimating cash-flow projections
24.2.6P4 Preparation pro-forma income statements
24.2.6P5 Preparation pro-forma balance sheets
24.2.6P6 Calculation break-even point
24.2.6P7 Calculation profitability rations

24.2.7 PRESENTATION

24.2.7T0 *Specific Objectives*

By the end of the topic the trainees should be able to:

a) write a final business plan
b) make a presentation of the business plan

Content

24.2.7T1 Final business plan
i) Format
ii) Elements

24.2.7T2 Business plan presentation
i) Order of presentation
ii) Flow of ideas/content
iii) Communication style
iv) Appropriate display methods for final document

24.2.8 EMERGING TRENDS AND ISSUES IN BUSINESS PLANNING

24.2.8T0 *Specific Objectives*
By the end of the topic the trainees should be able to:
a) identify the emerging trends and issues in business plan
b) identify the challenges posed by emerging trends and issues in
c) business planning
d) explain various ways of coping with challenges posed by
e) emerging trends and issues business planning

Content

24.2.8T1 Emerging trends and issues in business planning

24.2.8T2 Challenges posed by the emerging trends and issues business planning

24.2.8T3 Ways of coping with challenges posed by emerging trends and issues business planning

Competence
The trainee should have the ability to: prepare a business plan

25.2.0 TRADE PROJECT

25.2.01 Introduction

This module is designed to equip the trainee with the necessary knowledge, skills and attitude required to understand the process of
undertaking a project including the construction and production of
a viable electronic equipment.

25.2.02 General Objectives

By the end of this module unit, the trainee should be able to:

a) develop hands on experience on project work
b) implement knowledge gathered during course work
c) acquire experience in technical report writing
d) develop the concept of record keeping
e) interpret technical drawings

25.2.03 Module Summary and Time Allocation

Trade Project

Code	Module Unit	Content	Time Hrs
25.2.1	Sources Of Information And Its Application	• Catalogs • Data books • Internet • Text books • Manuals • Magazines • Workshops	10
25.2.2	Construction And Project Report Writing	• Project selection • Assembly • Report writing • Presentation	40
Total Time			**50**

25.2.1 SOURCES OF INFORMATION AND ITS APPLICATION

Theory

25.2.1T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to identify sources of information

Content

25.2.1T1 Sources of information
i) Catalogs
ii) Data books
iii) Internet
iv) Textbooks
v) Manuals
vi) Magazines
vii) Workshops
viii) Consultation

25.2.2 CONSTRUCTION AND PROJECT REPORT WRITING

25.2.2T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to write a trade project report

Competence
The trainee should have the ability to:
i) Choose correct components, tools and materials
ii) Safely and correctly assemble the circuit onto a circuit board
iii) Encase and test the assembled circuit
iv) Maintain quality on finished job
v) Estimate materials and cost for a job
vi) Apply ethics and integrity at work

Content

25.2.2T 1 Project selection
i) Assembly
ii) Report writing
iii) Presentation

Practice

25.2.2P0 *Specific Objectives*
By the end of the unit, the trainee should be able to:
a) choose appropriate electrical/electronic components
b) simulate the circuit on a computer
c) observe safety when handling and mounting components
d) construct a functional

electrical/electronic device or equipment
e) perform tests at various stages of the circuit
f) encase the assembled project
g) perform final test on the encased project
h) present a project for award of grade

Content

25.2.2P1 Components identification
25.2.2P 2 Circuit simulation
25.2.2P3 Safety
25.2.2P4 Circuit construction
25.2.2P5 Prototype testing
25.2.2P6 Project casing
25.2.2P7 Final test
25.2.2P8 Presentation

Suggested Learning Resources

i) Assorted components
ii) Test instruments
iii) Comuters
iv) Circuit diagrams
v) Assembly diagrams
vi) Electronic toolkit
vii) Circuit boards
viii) Connecting wir3s
ix) Connecting wires
x) Solder wires
xi) marking and cutting tools

APPENDICES

I SUGGESTED TEACHING/LEARNING ACTIVITIES AND EVALUATION METHODS FOR THIS COURSE

The trainer may choose any of the following suggested teaching/learning and evaluation methods to enhance the training. The list is not exhaustive the trainer is encouraged to explore other emerging and suitable methods.

Suggested teaching / Learning Activities for this course

- Demonstrations
- Lectures
- Illustrations
- Field visits
- Case studies
- Field work
- Question and Answer
- Presentations
- Browsing Internet

Suggested Evaluation Methods for this Unit

- Written tests
- Practices
- Observations
- Quizzes
- Oral presentation
- Written Examination

II TOOLS AND EQUIPMENT FOR 20 TRAINEES

1.	AC Ammeters (multirange)	15
2.	DC Ammeters (multirange)	15
3.	DC Millimeter (multirange)	15
4.	Galvanometers (central zero)	10
5.	AC Voltmeters	10
6.	DC Voltmeters	10
7.	Multimeters (volts, ohms, Amps) multirange	10
8.	Tong Multimeters	5
9.	Digital Multimeter	5
10.	Insulation Resistance tester (megger	4
11.	Line Earth Loop Impedance tester	2
12.	Transistor Tester	5
13.	Electrodynamic wattmeter (Single phase)	5
14.	Cathode Ray Oscilloscope (CRO)	5
15.	Tachometers	5
16.	High Temperature thermometers	5
17.	Digital Wattmeter (single phase)	5
18.	Fire Extinguisher	3
19.	First Aid Kit	2
20.	Current transformers	5
21.	Power transformers – various sizes	5
22.	Auto transformers	5
23.	Variable transformers	5
24.	Bell transformers 240 volts	5
25.	Bell transformers 12volts	5
26.	Universal Motor	5
27.	D.C Compound motor	5
28.	3 phase induction motor	5
29.	3 phase synchronous motor	5
30.	3 phase wound rotor motor	5
31.	Single phase Capacitor motor	5
32.	Split phase motor	5
33.	Shaded pole motor	5
34.	Repulsion induction motor	5
35.	Magnetic relays 12 volts	10
36.	Magnetic relays 240 volts	10
37.	Single Phase magnetic Contactors(240V	15
38.	3 Phase Magnetic Contactors	15
39.	Face plate starter	5

40. Counter emf starter	5
41. Drum controllers	5
42. SCR Speed controllers	5
43. Time delays relays	5
44. Direct on-line starters	10
45. Inertia Load	5
46. Pony brace	5
47. Start-stop pushbuttons	10
48. Bench Vices	5
49. Pipe Vices	5
50. Drill Press	5
51. Hand Drill	5
52. Grinder	1
53. Conduit Benders (Various Sizes)	5
54. Distribution Boards, Consumers' Unit 60/80 Amp Cut Outs	5
55. Ripple Relay	5
56. Fluorescent Fittings(300mm, 600mm)	5
57. Power Supply units AC/DC (0 – 240v)	5
58. Bell Indicators Boards (240 volts a.c)	5
59. Bell Indicators Boards (12 volts d.c)	5
60. Decade Resistance Boxes, (500 Watts)	5
61. Rheostats	10
62. Potentiometers	10
63. New and used Electrical Appliances cookers, loans refrigerators etc	
64. Solar module(solar panel-40/80 Watts)	5
65. Parabolic reflectors	1
66. Dish reflectors	1
67. Box reflectors	1
68. Flat plate collectors	1
69. Charge controllers	5
70. Solar Batteries-2X80 AMP HRS	5
71. Inverters	5
72. Solar system service equipment tools and accessories(petroleum jelly, tools, hydrometer, gloves, battery water, measuring instruments)	
73. Pliers – various types and sizes	5 each
74. side cutters	5
75. Electrician's knives	5
76. Screw drivers- various types of sizes	5 each
77. Phase testers	5
78. Precision screw drivers	

79. Nut drivers set	1
80. Hammers (claw and ball pein)	5
81. Mallets – brass wood	5
82. Knockout punch set	5
83. Chisels various types and sizes	
84. Centre punch	5
85. Prick punch	5
86. Drift punches	5
87. Scribers	5
88. Steel rules	5
89. Vernier callipers	5
90. measuring tape (steel – 3m)	5
91. Micrometer	5
92. Plumb bobs	5
93. Spirit levels	5
94. Framing square	5
95. Try square	5
96. Pipe stocks and dies(20mm)	5
97. Pipe stocks and dies(25mm)	5
98. Pipe wrench	5
99. Pipe cutter	5
100. Vice grip pliers	5
101. Fish tape	5
102. PVC Pipe bending spring (heavy duty, 20mm)	5
103. Hand reamers	5
104. Drill gauge	5
105. Standard wire gauge	5
106. wire strippers	5
107. Crimping tool	5
108. MIMS cable terminating tools	5
109. Allan screws set	5
110. Adjustable wrenches	5
111. Tap wrench	5
112. Bradawl	10
113. Blow lamps	5
114. Soldering Irons(various ratings)	5 each
115. Solder pot	
116. Files-various types and sizes	5 each
117. Tin snips	5
118. Hack saws	5
119. 8088 Micro-processor trainer kits	5
120. A model generator training kit	5

121. VCR, VCD, DVD, Laser Disc and Video Cameras 5
122. AM/FM Radio sets and the manuals 5
123. AM/FM radio training systems(kits) – RTS 4000 complete with manual 5
124. Circuit maker – a soft ware
125. Auto-CAD application program
126. Auxiliary hold –on relays 10
127. Bread board 5
128. Calculator
129. Computer
130. AC /DC portable power supply units 5
131. Electronic work bench application program to install in all computers
132. Electronics components- diodes, resistors, capacitors, transistors, potentiometer
133. Filler metal and fluxes
134. Folding machine
135. Hack saw frame and blades 5
136. Hand tools - complete metal work tool kit 5
137. IEE regulation book 3
138. Limit switches 5
139. Linked switches 5
140. Machine mounting rails 5 sets
141. Masonry wall
142. Mercury switches 5
143. Metal conduit and fittings
144. Energy meters – single phase 5
145. Energy meters – Three phase 5
146. Microprocessors Peripheral devices
147. MIMs termination tools
148. Over current protection - miniature circuit breakers (various ratings)
149. PLC trainer kits – WW12 series
OR LDA-PLC – 01 5 5
150. Rivet gun and rivets 5
151. Signal generator 5
152. Signal injector 5
153. Television sets (colour, black and white) 5
154. Transformers – (VARIOUS RATINGS – 240/4V,8V,12V,24) 5
155. Transistor catalogues data book 2
156. Various AC(single phase, three phase) and DC motors
157. Various discharge lamps

158.	Ward Leonard speed control set	1
159.	Consumer control unit	5
160.	3 phase distribution boards	5
161.	Switches and pat tresses.	Enough
162.	Ceiling roses.	Enough
163.	Bell circuit accessories.	Enough
164.	13 Amps socket outlets	Enough