NCDC
NATIONAL CURRICULUM DEVELOPMENT CENTRE

NATIONAL CERTIFICATE IN COMPUTER MAINTENANCE AND REPAIR

NCCM

Teaching Syllabus

NCDC
NATIONAL CURRICULUM
DEVELOPMENT CENTRE

NATIONAL CERTIFICATE IN COMPUTER MAINTENANCE AND REPAIR

NCCM

Teaching Syllabus

NCDC
NATIONAL CURRICULUM
DEVELOPMENT CENTRE

A product of the National Curriculum Development Centre for the Ministry of Education and Sports

Published by

National Curriculum Development Centre
P.O. Box 7002,
Kampala- Uganda
www.ncdc.co.ug

ISBN: 978-9970-00-145-3

Contents

Foreword

Government of Uganda through the National Curriculum Development Centre (NCDC), under the Ministry of Education and Sports embarked on reviewing the Business, Technical and Vocational curricula to make it competence based as advocated for by the BTVET Strategic Plan (2011 – 2020) of "Skilling Uganda". The government emphasis has been placed on provision of knowledge, skills and work attitudes for majority of Ugandans with a view of improving service delivery and increasing productivity of the citizens.

To ensure quality and standards across the country, the Ministry through NCDC in partnership with the various institutions that had developed individual curricula took up the responsibility of harmonising the curriculum materials for both private and public institutions. Government further streamlined the post Ordinary level programmes to run for two years, with the aim of equating such qualifications to the Advanced Certificate of Education, allow for progression, and in accordance with the recommendations of the Government White Paper (1992).

The harmonisation of this curriculum was premised on the current labour market demands, making it learner-centred, and competence-based. It focuses on core tasks and continuous assessments, with each semester involving execution of a real life project that makes the graduate competent in the field of work.

The increasing numbers of enterprises established in the country require manpower. As such, the National Certificate in Computer Maintenance and Repair programme is aimed at equipping learners with skills in Computer Maintenance and Repair so as to work and relate with other members of the society in harmony.

Computer Maintenance and Repair is thus one of the programmes that support the achievement of the Government's goal of employment creation; and when well implemented, will enable learners to perfect their professional attitudes in Computer Maintenance and Repair and towards job creation and self-employment.

As Minister responsible for the provision of education in the country, I therefore endorse the curriculum for National Certificate in Computer Maintenance and Repair as the official one to be taught by all institutions engaged in running this programme in Uganda.

Hon. Janet K. Museveni
First Lady and Minister for Education and Sports

Acknowledgement

National Curriculum Development Centre (NCDC) extends her appreciation to all panel members who participated in developing this syllabus for National Certificate in Computer Maintenance and Repair. Great thanks go to the following institutions that provided participants who worked tirelessly to make better the curriculum for skills development:

The Ministry of Education and Sports, Uganda Colleges of Commerce (UCCs), Uganda National Examinations Board (UNEB), the Directorate of Education Standards (DES), Universities, and the various institutions under the UGAPRIVI umbrella.

Special thanks go to Uganda Business and Technical Examinations Board (UBTEB) for the financial support that enabled the successful review and harmonisation of the various curricula, as well as their contributions towards the implementation policies.

The consultants are greatly applauded for the guidance provided during the development of the professional profiles. Special thanks go towards each and every individual who has worked behind the scenes to ensure successful completion of this curriculum.

We shall always be grateful for your ideas, time and efforts offered towards the design of this National Curriculum.

Grace K. Baguma
Director
National Curriculum Development Centre

Acronyms and Abbreviations

BCD	Binary coded Decimal
BTVET	Business. Technical and Vocational Education and Training
CBET	Competence Based Education and Training
CD	Compact Disc
CGPA	Cumulative Grade Point Average
CGPA	Cumulative Grade Point Average
CH	Contact Hours
CPC	Community Polytechnic Certificate
CPU	Central Processing unit
CSS	Cascading Style Sheets
CU	Credit Units
DC	Direct Current
DVD	Digital versatile Disc
ELE	Electronic Learning and Teaching Environment
FVH	Field Visit Hour
GP	Grade Point
HTML	Hyper Text Mark-up Language
ICT	Information Communication Technology
IC	Integrated Circuit
JVC	Junior Vocational Certificate
LAN	Local Area Network
LH	Lecture Hours
MoES	Ministry of Education and Sports
NCCM	National Certificate in Computer Maintenance and Repair
NCDC	National Curriculum Development Centre
OS	Operating System
PH	Practical Hours
PC	Personal Computer
RAM	Random Access Memory
RJ45	Registered Jack 45
ROM	Read Only Memory
TH	Tutorial Hour
UBTEB	Uganda Business and Technical Examinations Board

UCE	Uganda Certificate of Education
URL	Uniform Resource Locator
USMT	User State Migration
VDU	Visual Display Unit
WAN	Wide Area Network
WOW	World of Work
WWW	World Wide Web

Introduction

With the increased need for information and communication technology, the demand for computer maintenance and repair continues to show an increasing trend. This calls for computer technicians to be equipped with modern knowledge, skills and attitudes in order to competently fit in the ever changing labour market. This need culminated into the development of a curriculum for National Certificate in Computer Maintenance and Repair (NCCM) to address the contemporary needs of the labour market by making it competence-based.

This curriculum is in line with the BTVET Act of (2008), the BTVET Strategic Plan 2011–2020 of "Skilling Uganda" and the Uganda Vision 2040. The modules offered in this programme are packaged in a manner that will enable the learner to attain particular skills required for performing tasks in the world of work. The competences that the learner is expected to acquire are clearly spelt out in the modules covered in each of the two semesters of an academic year.

Modules such as Computer Applications; Kiswahili; Basic Communication Skills, are aimed at enhancing the learner's communication, report writing, and presentation skills.

Modules of Operating System Software, Programming Language Fundamentals, Electronic Communication Networks, Basic Electricity, PC Maintenance Tools & Devices, PC Maintenance and Repair, Digital Electronics and Ethics in Computing, will enable the learner to demonstrate physical skills in repairing computers.

Industrial Training which is done at the end of each academic year is aimed at bridging the gap between institutional-based training and the world of work.

This curriculum includes a professional profile, which was developed as an amalgamation of the various tasks from which modules have been formed.

The skills to be acquired will enhance the learners' confidence and ability to participate effectively in income generating activities, not only as members of the business world, but also as creative citizens dealing with issues emanating from the works that impact on their and other people's lives.

When effectively implemented, this curriculum will produce graduates with knowledge and skills to:

a) manage computer software;
b) maintain computer hardware; and
c) handle network problems.

General Guidelines and Regulations

Programme Title

The programme shall be called National Certificate in Computer Maintenance and Repair (NCCM).

Duration of the Programme

The NCCM is a full time programme taught for two academic years. Each academic year will be divided into two semesters. Semester 1 and 2 will consist of seventeen (17) weeks, comprising of fifteen (15) weeks of teaching, learning and continuous assessment and two (2) weeks of practical and written examinations.
In case of any challenge, the programme should be completed within a timeframe of **five** years from the time of enrolment and registration.

Admission/Entry Requirements

A candidate shall be eligible for admission to the NCCM programme on meeting any of the following minimum qualifications:

a) **Ordinary Level Entry Scheme (Uganda Certificate of Education Entry Scheme)**
The candidate should be a holder of Uganda Certificate of Education (UCE) with at least three passes obtained in the same year of sitting.

b) **Certificate Entry Scheme**

The candidate should hold a Junior Vocational Certificate (JVC) or Community Polytechnic Certificate (CPC), obtained from any recognised institution.

Curriculum Implementation

The NCCM curriculum is based on a modular system. During the training, continuous assessment shall be carried out as a competence based education and training (CBET) requirement. Each module contains sub-modules that will help the learner to understand how to perform the core tasks through:

- applied knowledge,
- practical involvement, and
- professional attitude.

The learner will also have to carry out a real life project to put into practice the knowledge and competences acquired in class.

Prospects for National Certificate in Computer Maintenance and Repair

NCCM graduates may opt to further their education and improve on their skills by offering a diploma and or degree in Computer Maintenance and Repair; Information Technology, or any other vocational program of one's choice.

Assessment Criteria

Each module shall be assessed out of 100 marks as follows:

Continuous assessments	40%
Final examinations	60%

Continuous assessments

These shall be either individual based or group assignments. They will consist of:

- Practical work
- Classroom exercises and presentations
- Assignments
- Tests
- Industrial Training and projects execution

There shall be final examinations within the last two weeks of every year set and conducted by UBTEB. A candidate shall be considered to have acquired a competence on performing tasks required in the labour

market. One must have attended at least 75% of the module and undergone both continuous assessment and end of year examinations. Continuous assessment shall be handled by the training institutions and verified by UBTEB officials.

Project Work

This involves a combination of subjects' knowledge, process skills and transferable abilities. Learners have to apply classroom knowledge and skills proactively in a real-life context for an extended period of time. Each learner will be required to run a real life project outside classroom time. At the end of every academic semester, a learner should have a visible real life project on the ground to be authenticated by UBTEB.

The teachers shall continuously assess project work and mark it out of 100% just like other modules. This shall be based on both the final product and the process involved in making it. A team of examiners from UBTEB shall move around to assess the implementation, authenticity, and progression of the projects.

The following guideline may be considered for project assessment:

Innovation and creativity	10 marks
Customer care	10 marks
Neatness	10 marks
Record keeping	10 marks
Health and safety observation	10 marks
Actual performance	20 marks
Final product	20 marks
Project report	10 marks
TOTAL	**100 marks**

Industrial Training

Every learner must get a placement for Industrial Training to be done at the end of each academic year. Industrial Training shall be assessed out of 100% as a full module considering the following areas:

Attendance	05 marks
Time management	05 marks
Teamwork	05marks

Creativity and innovativeness	15 marks
Customer care	10 marks
Health and safety	15 marks
Actual performance	25 marks
Written report	20 marks
---	---
Total	**100%**

Samples of assessment forms for the academic and the field supervisors are provided in the appendices.

UBTEB shall verify the authenticity of the Industrial Training marks awarded by the two supervisors by sending their representatives to visit the trainees at the organisations where they will be placed and working.

Awards

A learner who completes the programme and does not attain at least 2.0 grade point average (GPA) in some modules shall be awarded a "**Competence Certificate**" by UBTEB for the modules passed. The competence class Certificate shall enable the learner to have a specialised upgrading and employment since he/she will have attained useful competences and skills in the specialised field.

On completion of year one, a learner will be entitled to **A Statement of Results** by the examining body indicating the grades obtained in each module.

Module Credits AND THE Weighting System

1. Each module will be weighed using the credit units (CU).
2. One credit unit is equivalent to 15 contact hours (CH) per semester.
3. A contact hour can either be a teaching/lecture hour (LH), tutorial hour (TH), field visit hour (FVH) or practical hour (PH).
4. One contact hour is equivalent to one classroom teaching hour, two tutorial hours or two practical /field visits hours.
5. Modules are weighed according to credit units (CU) ranging from a minimum of 2.0 to a maximum of 5.0 based on their core relevancy in the area of specialisation.

Hence a module weighed 2 CU would take 30 contact hours, 3 CU would take 45 contact hours, 4 CU would have 60 contact hours, and 75 contact hours

for a module with 5 CU. No credit unit shall be awarded to any module in which a learner obtains less than 2.0 grade points.

Grading of Modules

Each module shall be graded out of 100 marks and assigned an appropriate letter grade and grade points as follows:

Marks (%)	Letter Grade	Grade Points
80-100	A	5.0
75-79	B+	4.5
70-74	B	4.0
65-69	C+	3.5
60-64	C	3.0
55-59	D+	2.5
50-54	D	2.0
0 – 49	F	0

Cumulative Grade Point Average (CGPA)

The grading of NCCM awarded to a learner shall be according to the Cumulative Grade Point Average (CGPA) score. The minimum pass grade point for each module is 2.0. The final marks for a module shall be converted into Grade Points (GP).

Computation of the CGPA

The learner's CGPA at a given time shall be obtained by:

1. Multiplying the grade points obtained in each module by the corresponding credit units assigned to the module to arrive at the weighted score for that module.
2. Adding together the weighted scores for all modules up to that time.
3. Dividing the total weighted scores by the total number of credit units taken up to that time.

Classification of the Certificates

The NCCM shall be classified according to the CGPA obtained up to the end of the programme. The certificates shall be classified as follows:

Class	CGPA
Distinction	4.30 – 5.00
Credit	2.80 – 4.29
Pass	2.00 – 2.79

Retaking a Module

Retaking will require a learner to redo the entire module by attending lectures, doing continuous assessment, and sitting the final examinations of that module. There shall be no supplementary examination or tests set for any retake but a learner will re-do the paper when the module is next examined.

A learner may also retake a module to improve the grades obtained at the first sitting. Should the learner get a lower grade for a retake, his/her original grade should prevail. A learner should be allowed a maximum of three retakes for a module. Whenever a module is retaken and passed, the academic transcript should **not** indicate so.

Dead Year

A learner shall be allowed to apply for a dead year of study due to financial constraints, sickness or any other genuine problem and should be allowed to resume the programme at the level he/she exited for the dead year. A learner who applies for a dead year shall also have to complete the programme within duration of five (5) years from the time of enrolment and registration into the programme.

Academic Year Load

A learner shall carry a maximum of 25 Credit Units per semester. Each academic year shall contain a maximum of eight modules/assessment units including project work.

Teaching and Learning Methods

The teaching and learning methods in this syllabus are just samples. It is at the teacher's discretion to apply any other methods deemed suitable to the classroom setting. The type of methods selected should be guided by the competences to be acquired by the learner. The teacher is encouraged to use a variety of methods in a lesson to make it more interesting and practical. Examples of some of the teaching and learning methods include:

1. Discussion

a) Group discussions

Learners discuss issues in groups. This methodology enables knowledge/information to come from the learners rather than from the teacher. It promotes teamwork and allows all learners to have an opportunity to give their opinions and ideas; and also stimulates their interest as they learn from each other.

Guidelines for using group discussion method:

i) Group learners
ii) Give clear instructions to learners as to what each group should do.
iii) Assign task(s) to each group.
iv) Give instructions on the pattern to be followed when discussing to ensure that each individual in the group contributes.
v) Monitor the group discussions to ensure that the social skills development takes place.
vi) Assign responsibilities to learners for positions of Chairperson, Secretary, Timekeeper, etc. for effective group dynamics.
vii) Learners discuss issues raised in the task with the guidance of the teacher.
viii) Learners agree on the issues to be presented.
ix) Group presentations and general discussions.
x) Summary of agreed class points and feedback by both the teacher and the learners.

b) Guided discussions

Guidelines for using guided discussion method:

i) The teacher leads the discussion and acts as the chairperson/secretary.

ii) The teacher give clear instructions to learners as to what they should do.
iii) Learners discuss issues raised in the task with the guidance of the teacher.
iv) Learners agree on the issues.
v) The teacher summarizes the session by drawing on the main points.

2. Case Study

This method is where learners are given information about a situation and they have to come up with decisions or solutions to a problem. The purpose of case study is to:

i) help learners to identify and solve problems in a typical situation.
ii) provide learners with confidence in decision making.
iii) help learners develop analytical skills.

3. **Brainstorming**

This is a way of obtaining as many views as possible from the learners in a short time. The learners should be guided to give as many ideas as they can on a particular issue. It is recommended that all ideas are accepted without questioning. The ideas should be ranked according to the relevancy to the issue being brainstormed.

Basic rules for brainstorming

i) Encourage as many ideas as possible.
ii) Criticisms of ideas should not be allowed.

4. Buzz method

This is a method of training that requires learners seated near each other to discuss an issue that could have a lot of points or controversies to be agreed upon. The noise is the murmur that the class makes like that of buzz. Therefore, some manageable noise or murmur should not be mistaken for not learning. This method is good in situations where one cannot conduct effective training due to some external interference such as raining or some learners appearing to be bored, or dozing.

The teacher asks questions on what learners have buzzed on to find out if they have understood.

5. Guided Discovery

This method is based on the notion that the learners know more than they think they know. The assumption is that they only need to be prompted to discover this knowledge for themselves. The teacher's role is to organise the learning environment and present the content in such a way that the learners can discover more knowledge and ideas.

6. Demonstration

This is the act of exhibiting, describing and explaining the operation or process by use of either a device, machine, process or product to learners. A demonstration can be carried out by the teacher or learners.

7. **Illustration**

This is a depiction or representation of a subject matter, such as a drawing, sketch, painting, photograph, or other kind of image of things seen, remembered or imagined, using a graphical representation. This method is best used where words are not sufficient to clearly bring out a concept. It gives a visual impression to what is being taught.

8. Guest Speaker

Guest speakers could be local entrepreneurs, government officials, professional practitioners, or community leaders invited to make a presentation to learners. Guest speakers can provide a variety to the entrepreneurship education learning, share experience, add value by engaging learners in an educational or informative manner.

The method provides learners with an opportunity to physically interact with a practitioner and motivate them to develop an entrepreneurial attitude.

9. Role Play

This method is where learners are presented with a situation they are expected to explore by acting out the roles of those represented in this situation. The role play learners should be carefully selected and properly prepared for their roles. The remaining learners should be equally prepared for the role play by briefing them on how they are to act during the presentation. The players should try to behave naturally during the presentation.

The teacher:

i) observes when the presentation is taking place.

ii) guides learners in the course of presentation to ensure that they focus on the theme of the play.

iii) engages learners in a discussion or asks them questions about what they have learnt from the role play with a view of finding out if the role play has provided sufficient information.

10. Study Tour

This is when learners are taken out to perform particular tasks with the aim of carrying out an observation, practice or witness the flow of events. It enables the learners to link the school situation with the reality in the communities or world of work.

11. Field Attachment

This is when learners are attached to some entrepreneur(s) to practice during their study time. It does not only enable them to relate what they have learnt in classroom but also allows them to acquire more knowledge and skills beyond what was covered. It further motives learners to becoming practitioners or entrepreneurs.

Final Paper Examinations Format

Year 1 Semester 1 Examinations Format

Paper Name and Code	Examination Format
NCCM 111: Computer Fundamentals NCCM 112: Basic Electricity NCCS 112: Basic Communication Skills NCBM 113: Basic Mathematics	Each paper shall consist of **seven** questions and the candidate is required to answer any **five. All** questions carry **equal** marks. The questioning techniques to be applied should seek the candidate's ability to remember, comprehend, apply, analyse, synthesise and evaluate conditions. The total duration of the examination is **2 hours and 30 minutes.**
NCCM 114: Real life Project 1	**The paper shall consist of continuous assessment marks.** The examinations board shall verify the authenticity of the awarded marks from the completed projects on the ground and learners' participation through presentations. The total duration of the examination is during the 15 weeks of teaching.

Year 1 Semester 2 Examinations Format

Paper Name and Code	Examination Format
NCCM 121: Operating System Software NCCM 122: Applied Technician Mathematic NCED 125: Entrepreneurship Skills	Each paper consists of **seven** questions and the candidate is required to answer any **five. All** questions carry **equal** marks. The questioning techniques to be applied should seek the candidate's ability to remember, comprehend, apply, analyse, synthesise and evaluate conditions. The total duration of the examination is **2 hours and 30 minutes**.
NCCA 124: Computer Applications	The paper shall consist of **three practical** questions carrying **50 marks each**. A candidate will be required to answer **any two**. A print out of the practical outputs together with the softcopies of all files used will be sent to the assessing body. The questioning techniques to be applied should seek for the candidate's ability to, comprehend, apply, analyse, synthesise and evaluate conditions. The duration of this examination shall be **2 hours**.
NCCM 123: Real life Project 2	**The paper shall consist of continuous assessment marks.** The examinations board shall verify the authenticity of the awarded marks from the completed projects on the ground and learners' participation through presentations. The total duration of the examination is during the 15 weeks of teaching.
NCCR 126: Industrial Training 1	**The paper shall consist of continuous assessment marks.** The examinations board shall verify the authenticity of the awarded marks from the completed projects on the ground and learners' participation through presentations. The total duration of Industrial Training is a minimum of 6 weeks.

Year 2 Semester 1 Examinations Format

Paper Name and Code	Examination Format
NCCR 213: Computer Ethics NCCM 212: Electronic Communication and Networks	Each paper consists of **seven** questions and the candidate is required to answer any **five. All** questions carry **equal** marks. The questioning techniques to be applied should seek the candidate's ability to remember, comprehend, apply, analyse, synthesise and evaluate conditions. The total duration of the examination is **2 hours and 30 minutes.**
NCCM 214: Computer Systems Architecture and Logic	The paper shall consist of two papers, **I [**Practical questions**]** and **II [**Knowledge questions**]**. Paper I shall consist of **one compulsory** practical question and will be marked out of **40 marks**. The total duration of the examination for **Paper I** will be **6 hours.** Paper II shall consist of **seven** questions and will be marked out of **100 marks** and then computed to 60 **marks.** The candidate will be required to answer **any five.** Each question will carry **20 marks.** The total duration of the examination for **Paper II** will be **3 hours.**
NCCM 211: PC Maintenance Tools and Devices	The paper shall consist of two papers, **I [**Practical questions**]** and **II [**Knowledge questions**]**. Paper I shall consist of **one compulsory** practical question and will be marked out of **40 marks**. The total duration of the examination for **Paper I** will be **6 hours.** Paper II shall consist of **seven** questions and will be marked out of **100 marks** and then computed to 60 **marks.** The candidate will be required to answer **any five.** Each question will carry **20 marks.** The total duration of the examination for **Paper II** will be **3 hours.**

Paper Name and Code	Examination Format
NCCR 215: Real life Project 3	**The paper shall consist of continuous assessment marks.** The examinations board shall verify the authenticity of the awarded marks from the completed projects on the ground and learners' participation through presentations. The total duration of the examination is during the 15 weeks of teaching.

Year 2 Semester 2 Examinations Format

Paper Name and Code	Examination Format
NCCM 221: Programming Fundamentals in C++ NCCM 222: Digital Electronics	Each paper consists of **seven** questions and the candidate is required to answer any **five. All** questions carry **equal** marks. The questioning techniques to be applied should seek the candidate's ability to remember, comprehend, apply, analyse, synthesise and evaluate conditions. The total duration of the examination is **2 hours and 30 minutes**
NCCM 223: PC Maintenance and Repair	The paper shall consist of two papers, **I [**Practical questions**]** and **II [**Knowledge questions**]**. Paper I shall consist of **one compulsory** practical question and will be marked out of **50 marks**. The total duration of the examination for **paper I** will be **6 hours.** Paper II shall consist of **three** questions and the candidate will be required to answer **two**, each question will carry **25 marks.** The total duration of the examination for **paper II** will be **2 hours.**
NCKS 223: Kiswahili	The paper shall consist of **two** examinations; thus Paper **One** and **Two** Paper one will consist of **two** sections **A** and **B**

Paper Name and Code	Examination Format
	Section A will comprise of **one (1) compulsory** question of 20 marks involving **listening** and **speaking** skills. The question will be recorded information to be played to the candidates after which they will write down the answers to the questions that will follow in the question paper provided. This should take **1**hour and **30** minutes Section B shall consist of **4 (four)** questions and the candidate will be required to answer any **2 (two)** in **one** hour. Each of these questions shall be marked out of 20 marks. Paper **two** will consist of several oral questions where a candidate will directly interface with the examiner and answer the questions in 15 minutes while the marks are recorded. The paper will carry a total of **40** marks.
NCCM231: Industrial Training 2	**The paper shall consist of continuous assessment marks.** The examinations board shall verify the authenticity of the awarded marks from the completed projects on the ground and learners' participation through presentations. The total duration of Industrial Training is a minimum of 6 weeks.

Focus of Education

The focus of education for NCCM emphasises on the following aspects of learning:

i) Competence-based.
ii) Expert assignments with supporting modules.
iii) Integrated education (knowledge, skills and positive attitude).
iv) Innovation and initiative; (how to learn and solve problems that one has never met before).

v) Upward mobility and concentric curriculum: first year gives a picture of the second year and the profession (intensification).
vi) Entrepreneurship and creativity oriented.
vii) Environmental, health and safety considerations.
viii) Sports, clubs and social interactions.
ix) Focus on the disabled, gender and equity.
x) Sustainability, professional practice, general and specialised law.
xi) Modularised programmes.
xii) Communication skills and understanding of society.
xiii) Real life individual/group projects.

Assignments (Individual/Group)

Assignments to be done by learners shall either be individual based or in groups. These will include:

i) Real–life (individual / group practical) projects
ii) Laboratory testing of materials
iii) Workshop practical
iv) Classroom theoretical exercises/tutorials and practical exercises
v) Classroom practical exercises such as drawing
vi) Communications; oral presentation, email, and report writing
vii) Take home assignments to test knowledge and ability to research
viii) Examinations and tests to gauge individual acquisition of knowledge and skills
ix) Workshop and field visits as well as case studies
x) Information communication technology (ICT)

Role of the Learner

The learners of NCCM are tasked with various roles and these include:

i) Participate fully in class work and assignments.
ii) Be resourceful in group and personal research.
iii) Seek guidance.
iv) Learn to communicate - oral presentation, report writing and development of personal interactive skills.

v) Learn to solve problems they have never faced before (initiation and innovation).
vi) Participate in community-based real life projects.
vii) Asses the performance of staff and usefulness of programmes.
viii) Serve as ambassadors of the institution to the world of work.
ix) Learn to work independently and as part of a team.
x) Keep time, manage oneself and other people effectively.
xi) Participate in sports, social and guild activities.
xii) Participate in environmental health, safety and security awareness and other cross cutting issues.
xiii) Practice leadership roles.
xiv) Learn practical and entrepreneurship skills to enable them start up projects on their own.
xv) Maintain discipline in and outside the institution.

Role of Teaching Staff

The teaching staff should:

i) Prepare schemes of work and lesson plans.
ii) Keep records of attendance, assessment and discipline.
iii) Serve as teachers, lecturers, supervisors and coaches.
iv) Serve as consultants/supervisors for learners' projects and assignments.
v) Assess learners' performance.
vi) Contribute to continuing innovation in education.
vii) Counsel and guide learners on career and social issues that may affect their studies.
viii) Arrange for and carry out internship training placement and supervision.
ix) Arrange field tours and site visits.
x) Prepare learners for project work as well as assess and record learners' progress.
xi) Guide learners in project design and writing.
xii) Collaborate in interdisciplinary activities.
xiii) Assess effectiveness of the programmes.

xiv) Be ethical and role models to the profession.

xv) Carry out research, write papers or publish technical books.

xvi) Constantly update themselves on the industry's developments and requirements.

Role of non-Teaching and Support Staff

Non-teaching staff includes all members who are not directly involved in the Teaching and Learning process of NCCM. They are very vital to the running of this programme and without them other sectors cannot function. Their roles are to:

i) ensure clean, healthy and attractive working and learning environment for learners and lecturers.
ii) ensure timely delivery of materials and services for effective learning process.
iii) maintain ethical and moral conduct.
iv) offer guidance and counselling to learners.
v) manage resources.
vi) ensure security of learners, institution and their / its property.
vii) be flexible and able to carry out any other duties assigned to them by the supervisors.

Role of Administrative Staff

The administrative staff should:

i) keep custody of institution property (inventories).
ii) plan for smooth running of the institution (mobilise funds and human resources).
iii) ensure equity and gender equality.
iv) link institution with government, world of work and other stakeholders.
v) support and facilitate learners' activities.
vi) carry out admission of learners.
vii) maintain and uphold the good image of the institution.
viii) ensure high academic standards of the institution.
ix) arrange for graduations and regular meetings of alumni.
x) maintain ethical and moral conduct.

xi) ensure safe and conducive learning environment.
xii) provide learners with adequate materials.
xiii) allow and facilitate inter-institutional activities.
xiv) ensure co-curricular management and its implementation.
xv) appraise staff performance.
xvi) ensure security of learners and their property.
xvii) ensure discipline among staff and learners.
xviii) recommend for promotion or disciplinary action among staff.
xix) appraise other staff.
xx) provide regular support to the Teaching and Learning process.

Effective Learning Environment

For successful implementation of NCCM, an effective learning environment must be provided, which includes:

i) Adequate physical infrastructure such as classrooms, laboratories, workshops and libraries equipped with relevant teaching and learning resources.
ii) Electronic learning and teaching environment (ELE) such as computers, projectors, printers, photocopiers and printers to support teaching and learning processes.
iii) Materials such as models, audio-visual aids, books, manuals, journals and equipment that offer learners and teachers professional situations.
iv) Adequate facilities to cater for administration and other logistical terms that adequately support the educational process.
v) Medical facilities, proper hygiene and sanitation, proper working and studying environment, good feeding, welfare and security for the learners and staff.
vi) Proper motivation and inspiration of staff and learners for them to commit to the certificate programme.
vii) Adequate arrangement of seminars, workshops and exhibitions, as well as sites and field visits.
viii) A platform for learners and staff to air out their views such as representation on governing councils.
ix) Professional personnel to adequately maintain all facilities such as dormitories.

Co-curricular activities

Co-curricular activities are part of the institution activities and they enhance Teaching and Learning process. Therefore the institution should ensure that there:

i) are adequate sports and recreational facilities;

ii) is an effective learners' guild through which sports, recreational, religious and cultural activities are channelled and organised, and supported by the institute administration without discrimination.

Professional Profile for the NCCM Graduate

Profile Name: Junior IT Support Technician

The IT Support Technician will be responsible for general maintenance of defined computer equipment and for the resolution of identified technical problems for commercial and domestic customers.

Competences	Duty	Tasks
By the end of the programme, the learner should be able to: • identify and use various types of computer software. • install and configure a computer system.	**Duty 1:** Software Management	• Test new software • Make software available to customers where requested • Ensure the anti-virus software is installed, kept up to date and working properly on all customers stations, where appropriate • Set up and maintain user e-mail accounts, when requested by customers • Provide troubleshooting resolution and updating/upgrading of software to customers
• identify the various hardware components of computers and their uses. • install and configure the entire computer system.	**Duty 2:** Hardware management	• Maintain customers' computer peripheral equipment, as requested • Assist other technicians in the office where required • Keep a log of all technical faults (support log) • Liaise with external suppliers for the repair of equipment under warranty or maintenance contract

Competences	Duty	Tasks
• setup and manage a local area network. • monitor and systematically support in troubleshooting computer related issues.		• Provide troubleshooting resolution and updating/upgrading of hardware to customers • Assist with and provide support/troubleshooting for server hardware
	Duty 3: Network Management	• Check the network backup daily for maintenance customers • Set up, maintain and remove user network accounts where appropriate • Carry out routine network maintenance tasks
	Duty 4: Office Administration	• Maintain stock for office and website gingerfoxit.com • Order office stationary where necessary • Arrange couriers for any deliveries in the office • Order for ink cartridges and toners for customers, as and when orders are placed • Check deliveries on arrival into the office

Personal Qualities
A Help Desk Technician should possess the following qualities: • Be able to work on his/her own initiative • Demonstrate practical knowledge and problem-solving strategies • Have high quality inter-personal skills • Keep abreast of new developments in software and hardware

Summary of the Programme Structure for NCCM

Year 1 Semester 1	LH	PH	CH	CU
NCCM 111: Computer Fundamentals	30	60	60	4
NCCM 112: Basic Electricity	30	90	75	5
NCCS 112: Basic Communication Skills	30	30	45	3
NCBM 113: Basic Mathematics	40	40	60	4
NCCM 114: Real life Project 1	10	100	60	4
Total Semester Load				**19**
Year 1 Semester 2	**LH**	**PH**	**CH**	**CU**
NCCM 121: Operating System Software	30	90	75	5
NCCM 122: Applied Technician Mathematics	45	30	60	4
NCCA 124: Computer Applications	20	80	60	4
NCDE125: Entrepreneurship Development	40	40	60	4
NCCM 123: Real Life Project 2	10	100	60	4
Total Semester Load				**20**
Recess Term				
NCCM 124: Industrial Training 1	0	240	-	4
Year 2 Semester 1	**LH**	**PH**	**CH**	**CU**
NCCM 211: PC Maintenance Tools and Devices	30	90	75	5
NCNC 212: Electronic Communication and Networks	20	80	60	4
NCCM213: Computer Ethics	30	30	45	3
NCCM 214: Computer Systems Architecture & Logic	30	60	60	4
NCCM 215: Real Life Project 3	10	100	60	4
Total Semester Load				**21**
Year 2 Semester 2	**LH**	**PH**	**CH**	**CU**
NCCM 221: Programming Fundamentals in C++	30	90	75	5
NCCM 222: Digital Electronics	30	60	60	4
NCKS 223: Kiswahili	30	30	45	3
NCCM 223: PC Maintenance and Repair	25	100	75	5
NCCM224: Real Life Project 4	10	100	60	4
Total Semester Load				**19**
Recess Term				
NCCM 225: Industrial Training 2	20	220	-	4

Detailed Modules Description of Year 1 Semester 1

NCCM 111: Computer Fundamentals

Duration: 60 Hours

Module Overview

The module equips the learner with knowledge about the components of a basic personal computer system.

Learning Outcomes

By the end of the module, the learner should be able to:

i) identify the hardware components of a computer.
ii) identify the different computer software.
iii) operate/use a computer system.

Sub-module 1: Introduction to Computer

Duration: 12 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • identifies and describes the application of computer hardware, CPU, hard disc drives, modems, mouse, and external speakers. • removes and replaces computer rams. • identifies and uses keyboard buttons as per their functions. • differentiates between letter and numerical buttons on the keyboard.	• Origin of computers • Types of computers and computer hardware (CPU, hard disk drives, modem, keyboard, etc) • Keyboard basics: function keys, numeric keys and	• Lead a guided discussion on types of computers and their uses. • Display computer hardware components and ask learners to identify and group the items to their correct order. • Lead a guided discussion on classification, usage, computer components; video card, network cards and cables. • Demonstrate the use of the keyboard, its buttons and other functions.

Competences	Content	Teaching and Learning Strategies
• typesets data into the computer using a keyboard. • opens and closes a computer. • restarts a computer and changes user accounts.	navigation keys • Starting a computer • Shutting down the computer.	• Demonstrate the typing techniques applied when using computer keyboard. • Demonstrate the procedure followed to open, change accounts and close a computer.

Assessment Strategy

Assign the learner practical exercises to:

i) Practice the keyboard application skills and techniques.
ii) Start, change accounts and close a computer.

Teaching and Learning Resources

- Computer components
- Mouse
- Keyboards
- CPU
- Monitor/screen
- Power generator

Sub-module 2: Computer Hardware

Duration: 10 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • identifies internal and external computer hardware. • differentiates types	• Internal PC hardware components • Input, output processing and	• Lead a guided discussion on identification of computer components.

Competences	Content	Teaching and Learning Strategies
of computer hardware. • installs computer hardware accessories. • uses computer hardware.	storage hardware devices and accessories • Replacement of computer accessories	• Demonstrate to learners how to install different PC hardware. • Illustrate the use of different PC hardware.

Assessment Strategy

Give learners exercises to:

i) identify and sort out computer hardware components according to their application.
ii) replace PC hardware.

Teaching and Learning Resources

- Computer components
- CPU
- Monitor/screen
- Power generator

Sub-module 3: Computer Software

Duration: 10 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • classifies different software. • identifies software with its application. • uses software. • installs software to computer.	• Computer software: classification, types, and usage • Hardware driver software • Anti-virus software • Installation/configuration manuals	• Display computer software and ask learners to identify and group the items to their correct order. • Lead a guided discussion on computer software,

Competences	Content	Teaching and Learning Strategies
• uninstalls software from a computer. • configures the software.		classification, usage. • Demonstrate how to install, uninstall and configure computer software.

Assessment Strategy

Assign learners to:

i) classify computer software.
ii) demonstrate usage of different software.
iii) install and configure computer software.

Teaching and Learning Resources

- Software
- Computers
- Mouse
- Keyboards
- CPU
- Monitor/screen
- Power generator

Sub-module 4: Memory and Storage Media

Duration: 10 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • identifies and describes different storage media and devices. • formats various storage media	• Computer memory types (RAM, ROM, DRAM, DDR and Cache Memory) • Types of RAM and performance • Memory modules	• Lead a guided discussion on the different types of memory and storage. • Display different memory and storage devices and ask learners to identify and classify them. • Demonstrate how to

Competences	Content	Teaching and Learning Strategies
and devices for usage. • uses different storage devices. • describes different computer memory and storage with their capacities.	(DIMMS, SIMMS and RIMMS) • Storage types; magnetic storage, flash storage and optical storage devices • Removable storage • Memory/storage sizes	format and use different storage devices. • Lead a guided discussion on the functions of different memory modules. • Guide learners on determination of storage capacity of different devices.

Assessment Strategy

Give learners exercises to:

i) format different storage devices.
ii) classify computer memory and storage.
iii) install and remove RAM from its modules.
iv) identify the different memory and storage capacities.

Teaching and Learning Resources

- Software
- Computer
- Ram sets

Sub-module 5: Internet and Email

Duration: 8 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • uses the Internet and email to search for notes, news and other required information.	• The Internet, web browsers • Opening a websites; website address (url) • Internet searching and search engines	Lead a guided discussion on use of the Internet, web browser and emails. • Demonstrate the procedure of opening up an Internet web, opening of a new

Competences	Content	Teaching and Learning Strategies
• signs in and creates an email address. • copies and saves information from the Internet and downloads files, music and pictures to the computer. • creates a strong password for the email address. • writes and sends email messages. • reads received mails. • uses the Internet for communication using social media, etc.	• Saving information from the Internet, downloading files, music, pictures to the computer • Electronic mail: - creating email accounts - email folders and attachments - attaching documents to outgoing email - downloading email attachment from incoming email - formatting mail - searching mail	email address and the creation of strong passwords for the email address. • Demonstrate the copying and downloading of documents, music, movies and pictures and the saving into the computer or CD or flash disc. • Demonstrate the opening and reading of mails, sending of mails and deleting of the received and read mails. • Demonstrate how to use social media tools.

Assessment Strategy

Give learners:

i) exercises to open email addresses, and write, send and open emails.

ii) homework to copy and download documents from the Internet web browser and save them on computers and other storage media.

Teaching and Learning Resources

- Computers
- Internet connection

Sub-module 6: Desktop Main Menu

Duration: 10 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • locates the desktop start menu. • creates desktop background and screen saver. • changes desktop background and screen saver. • resizes, opens windows by maximising and minimising to task pane. • closes and opens windows from task pane. • copies files from external drive, CD, DVD, flash disc to desktop. • identifies icons on desktop and their application.	• Start menu • Applications menu • Working with desktop; background, screen saver • Manipulating open windows; resizing, maximising, minimising, task pane, and tiling windows, etc • Copying files from different locations • Icons, files and folders	• Ask learners to locate desktop start menu. • Demonstrate the creation of desktop background and screen saver from default settings and from pictures or photographs saved in the computer. • Demonstrate the techniques of resizing, minimising and maximising open windows. • Demonstrate the techniques of copying files from external drives, CDs, DVDs, flash discs to desktop and vice versa. • Illustrate the application of various icons on desktop.

Assessment Strategy

Task learners to:

i) create desktop background and screen saver from default settings and pictures or photographs saved in the computer.

ii) resize, minimise and maximise open windows.

iii) copy files from external drives, e.g. CDs, DVDs and flash discs to a desktop and vice versa.

-

Teaching and Learning Resources

- Functioning computers
- External drives e.g. CDs, DVDs, flash discs
- Monitors/screens

Suggested References

Tutorials Point (2017), Computers Fundamentals. *https://www.tutorialspoint.com/computer_fundamentals/computer_fundamentals_tutorial.pdf*

Fundamentals of Computer. Question bank. http://nmu.ac.in/Portals/0/Question%20Bank/F.%20Y.%20B.%20Sc.(Computer%20Science)%20Paper%20I%20Question%20Bank.pdf

Casey, J. (2015). Computer Hardware: Hardware Components and Internal PC Connections. Guide for Undergraduate Students. Dublin Institute of Technology.

Anderson, D. and Tom, S. (1995). Pentium Processor System Architecture. 2nd Ed. Reading, Mass. Addison-Wesley. ISBN 0-201-40992-5

Ferraro, R. F. (1995). Programmer's Guide to the EGA, VGA, and Super VGA Cards. 3rd Ed. Reading, Mass. Addison-Wesley. ISBN 0-201-62490-7

Shanley, T. (1995). 80486 System Architecture. 3rd Ed. Reading, Mass: Addison-Wesley, ISBN 0-201-40994-1

Shanley, Tom (1995). ISA System Architecture. 3rd Ed. Reading, Mass. Addison-Wesley. ISBN 0-201-40996-8

Shanley, Tom (1999). PCI System Architecture. 4th Ed. Reading, Mass. Addison-Wesley. ISBN 0-201-30974-2

Van, G. F. (1996). The Undocumented PC. 2nd Ed. Reading, Mass: Addison-Wesley Pub. Co. ISBN 0-201-47950-8

Messmer, H. (2002). The Indispensable PC Hardware Book. 4th Ed. Reading, Mass: Addison-Wesley Pub. Co. ISBN 0-201-59616-4

NCCM 112: Basic Electricity

Duration: 75 Hours

Module Overview

Circuits and signals are foundational material for computer engineering. These areas provide the basic knowledge for the design of the circuits used in computers. Electromagnetic interactions play a central role in determining the structure of the natural world and are the foundation of most current and emergent technology. Therefore, this module provides learners with basic knowledge and skills in electricity and magnetism as being important in computer Engineering and Repair.

Learning Outcomes

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

i) uphold new concepts in AC and DC circuit analysis and be firmly convinced that the theorems and concepts hold practically.
ii) use various methods of circuit analysis, including simplified methods such as series-parallel reductions, voltage and current dividers, and the Kirchhoff's method.
iii) attach quantitative meaning to the basic laws of electricity and magnetism, and give daily-life analogies to the concepts studied.

Sub-module 1: DC Circuits

Duration: 12 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • identifies the different sources of direct current (DC). • distinguishes common electrical circuit diagram symbols. • explains electric current, potential and resistance	• DC sources • Common electrical circuit symbols • Electric current: definition and unit • Potential difference: definition and	• Brainstorm the different sources of direct current (DC). • Guide learners to illustrate the common electrical circuit diagram symbols. • Lead learners' discussion to explain electric current, potential and resistance

Competences	Content	Teaching and Learning Strategies
difference, and states their units of measure. • practices application of an ammeter, a voltmeter and an ohmmeter in an electric circuit. • describes Ohm's law and states its application. • explains conductors and insulators, stating their examples. • explains and calculates electrical power and describes the units of measure. • calculates electrical energy and states the units. • analyses the importance of fuses in electrical circuits.	unit • Resistance: definition and unit • Application of an ammeter, a voltmeter and an ohmmeter in an electric circuit • Ohm's law: description and application • Conductor and insulator: descriptions and examples • Electrical power: description, units and calculations • Electrical energy: description, units and calculations • Importance of fuses in electrical circuits	difference, and task them to state the units of measure of these quantities. • Guide learners to practice the application of an ammeter, a voltmeter and an ohmmeter in an electric circuit. • Demonstrate the application of Ohm's law DC circuits. • Task learners to explain conductors and insulators and state their examples. • Guide learners to calculate electrical power and describe its units of measure. • Guide learners in groups to calculate electrical energy and state the units. • Task learners to analyse the importance of fuses in electrical circuits.

Assessment Strategy

- Assign learners class work to calculate electrical power and electrical energy, and describe their units of measure.

Teaching and Learning Resources

- Computer
- Projector
- Sample electrical circuits
- Calculator

Sub-module 2: Series and Parallel DC Circuits

Duration: 12 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • analyses voltage division in a series circuit. • analyses current division in a two-branch parallel network • calculates for unknown voltages, current and resistance in a series and parallel circuit. • calculates for unknown voltages, currents and resistances in series-parallel networks. • discusses the advantages and disadvantages of series and parallel connection of lamps. • applies Kirchhoff's laws to determine unknown currents and voltages in DC circuits.	• Voltage division in a series circuit • Current division in a two-branch parallel network • Calculation of unknown voltages, current and resistances in a series circuit • Calculation of unknown voltages, currents and resistances in a parallel circuit • Calculation of unknown voltages, currents and resistances in series-parallel networks • Advantages and disadvantages of series and parallel connection of lamps • Kirchhoff's laws to determine unknown currents and voltages in DC circuits	• Guide learners to analyse voltage division in a series circuit. • Guide learners to analyse current division in a two-branch parallel network. • Use illustrations to guide in calculating for unknown voltages, current and resistance in a series and parallel circuit. • Guide learners to practice to calculate for unknown voltages, currents and resistances in series-parallel networks. • Lead group discussions on the advantages and disadvantages of series and parallel connections of lamps. • Task learners to apply Kirchhoff's laws to determine unknown currents and voltages in DC circuits.

Assessment Strategy

- Assign learners homework to calculate for unknown voltages, current and resistance in series and parallel circuits.

Teaching and Learning Resources

- Computer
- Projector
- Sample series and parallel DC circuits

Sub-module 3: AC Circuits

Duration: 14 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • explains the reasons for the preferred use of AC to DC. • describes the principle of operation of an AC generator. • distinguishes between unidirectional and alternating waveforms. • explains the basic AC circuit terms: cycle, period or periodic time T and frequency f of an AC waveform. • performs calculations involving $T = \frac{1}{f}$ • explains instantaneous,	• Why AC is used in preference to DC • Principle of operation of an AC generator • Distinguishing between unidirectional and alternating waveforms • Definition of: cycle, period or periodic time T and frequency f of an AC waveform • Calculations involving $T = \frac{1}{f}$ • Definition of instantaneous, peak, mean and rms values, and form and peak factors for a sine wave • Calculations involving mean and	• Brainstorm the reasons for the preferred use of AC to DC and the principle of operation of an AC generator. • Lead a guided discussion to distinguish between unidirectional and alternating waveforms. • Guide learners to explain the basic AC circuit terms: cycle, period or periodic time T and frequency f of an AC waveform. • Use illustrations to guide learners in performing calculations involving $T = \frac{1}{f}$ • Lead guided group discussions to explain

Competences	Content	Teaching and Learning Strategies
peak, mean and root mean square values (rms) values, and form and peak factors for a sine wave. • solves problems involving calculation of mean and rms values and form and peak factors for given waveforms. • illustrates phasor diagrams of current and voltage waveforms for single-phase series AC circuits. • performs calculations involving $X_L = 2\pi fL$ and $X_C = {}^{1}/_{2\pi fc}$ • draws circuit and phasor diagrams for R-L, R-C, R-L-C series AC circuits. • performs calculations involving R-L, R-C, R-L-C series AC circuits.	rms values and form and peak factors for given waveforms • Single-phase series AC circuits: - Phasor diagrams of current and voltage waveforms for: ➢ purely resistive ➢ purely inductive ➢ purely capacitive AC Circuits - Calculations involving $X_L = 2\pi fL$ and $X_C = {}^{1}/_{2\pi fc}$ - Circuit and phasor diagrams for R-L, R-C, R-L-C series AC circuits - Calculations involving R-L, R-C, R-L-C series AC circuits	instantaneous, peak, mean and rms values, and form and peak factors for a sine wave. • Guide learners' practice to solve problems involving calculation of mean and rms values and form and peak factors for given waveforms. • Guide learners to illustrate phasor diagrams of current and voltage waveforms for single-phase series AC circuits. • Task learners to performs calculations involving $X_L = 2\pi fL$ and $X_C = {}^{1}/_{2\pi fc}$ • Task learners to draw circuit diagrams and phasor diagrams for R-L, R-C, R-L-C series AC circuits. • Guide learners to practice to perform calculations involving R-L, R-C, R-L-C series AC circuits.

Assessment Strategy

- Give learners exercises involving calculation of $X_L = 2\pi fL$ and $X_C = {}^{1}/_{2\pi fc}$, and draw circuit diagrams and phasor diagrams for R-L, R-C, R-L-C series AC circuits.

Teaching and Learning Resources

- Computer
- Projector
- AC generator
- Sample AC circuits

Sub-module 4: Electrostatic Fields

Duration: 12 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • defines and states the units of: electric charge Q, electric potential V, and capacitance C. • carries out simple calculations involving $C = Q/V, \quad Q = It$. • describes the practical types of capacitors. • describes and states the units of electric field strength, E and electric flux density, D. • defines permittivity, and describes the difference between	• Definitions and units of: electric charge Q, electric potential V, capacitance C. • Simple calculations involving $C = Q/V, \quad Q = It$ • Practical types of capacitors • Descriptions and units of electric field strength E and electric flux density. D • Permittivity, difference between $\varepsilon_0, \varepsilon_r$ and ε	• Lead learners to define and state the units of: electric charge Q, electric potential V, capacitance C. • Guide learners to carry out simple calculations involving $C = Q/V, \quad Q = It$. • Task learners to describe the practical types of capacitors. • Lead group discussions for learners to describe and state the units of electric field strength E and electric flux density, D. • Guide learners to define permittivity, and describe the difference between $\varepsilon_0, \varepsilon_r$ and ε. • Use illustrations to guide

Competences	Content	Teaching and Learning Strategies
$\varepsilon_0, \varepsilon_r$ and ε. • carries out calculations involving $D = \frac{Q}{A}$, $E = V/D$ and $D/E = \varepsilon_0\varepsilon_r$. • describes the effective capacitance of capacitors in series and in parallel. • describes the phenomenon of parallel plate capacitors and carries out simple calculations on $C = \frac{\varepsilon_0\varepsilon_r A(n-1)}{d}$. • calculates for capacitance, charge, voltage and energy stored in capacitors connected in parallel and in series.	• Calculations involving $D = \frac{Q}{A}$, $E = V/D$ and $D/E = \varepsilon_0\varepsilon_r$ • Effective capacitance of capacitors in series and parallel • Parallel plate capacitors and simple calculations on $C = \frac{\varepsilon_0\varepsilon_r A(n-1)}{d}$ • Calculations of, capacitance, charge, voltage and energy stored in capacitors connected in parallel and in series	learners' practice to carry out calculations involving $D = \frac{Q}{A}$, $E = V/D$ and $D/E = \varepsilon_0\varepsilon_r$. • Lead group discussions to describe the effective capacitance of capacitors in series and parallel. • Guide learners' class discussion to describe the phenomenon of parallel plate capacitors and task them to carry out simple calculations on $C = \frac{\varepsilon_0\varepsilon_r A(n-1)}{d}$ • Task learners in groups to calculate capacitance, charge, voltage and energy stored in capacitors connected in parallel and in series.

Assessment Strategy

Assign learners to perform calculations involving $D = \frac{Q}{A}$, $E = V/D$ and $D/E = \varepsilon_0\varepsilon_r$

Teaching and Learning Resources

- Computer
- Projector
- Capacitors

Sub-module 5: Electromagnetism

Duration: 14 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • describes the magnetic fields produced by electric currents. • describes the characteristics of line of magnetic flux. • demonstrates the application of the screw rule to determine direction of magnetic field. • describes the magnetic field around a solenoid. • demonstrates the screw rule or grip rule to a solenoid to determine magnetic field direction. • describes the practical applications of an electromagnet. • explains the factors upon which the force f on a current-carrying conductor depends. • carries out	• Magnetic fields produced by electric currents • Characteristics of line of magnetic flux • Screw rule to determine direction of magnetic field • Magnetic field around a solenoid • Screw rule or grip rule to a solenoid to determine magnetic field direction • Practical applications of an electromagnet, i.e. electric bell, relay, lifting magnet, telephone receiver, dynamo • Factors upon which the force F on a current-carrying conductor	• Guide learners to explain the magnetic fields produced by electric currents. • Guide learners to describe the characteristics of line of magnetic flux. • Lead learners to practice demonstrations of the application of the screw rule to determine direction of magnetic field. • Task learners in groups to describe the magnetic field around a solenoid. • Guide learners through demonstrations to describe the screw rule or grip rule to a solenoid to determine magnetic field direction. • Lead group discussions on the practical applications of an electromagnet, i.e. electric bell, relay, lifting magnet, telephone receiver and dynamo. • Guide learners through illustrations to explain the factors upon which the force F on a current-carrying conductor depends. • Guide learners' practice to carry out calculations using $F = BIl$ and $F = BIl \sin\theta$.

calculations using $F = BIl$ and $F = BIl\sin\theta$ • demonstrates the principle of a loudspeaker as a practical application of force F. • applies the Fleming's left-hand rule to pre-determine direction of force in a current-carrying conductor.	depends • Calculations using $F = BIl$ and $F = BIl\sin\theta$ • A loudspeaker as a practical application of force F • Fleming's left-hand rule to pre-determine direction of force in a current-carrying conductor	• Task learners in groups to demonstrate the principle of a loudspeaker as a practical application of force F. • Guide learners to apply the Fleming's left-hand rule to pre-determine direction of force in a current-carrying conductor.

Assessment Strategy

- Assign learners to carryout calculations using $F = BIl$ and$F = BIl\sin\theta$, and use the Fleming's left-hand rule to pre-determine direction of force in a current-carrying conductor.

Teaching and Learning Resources

- Computer
- Projector
- Sample magnetic circuits

Sub-module 6: Electromagnetic Induction

Duration: 11 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • describes how an e.m.f. is induced in a conductor. • explains Faraday's laws of electromagnetic induction. • explains Lenz's law. • describes Fleming's right-hand rule for relative directions. • calculates $E = Blv$ and $E = Blvsin\theta$ • describes and states the units of self-inductance and mutual inductance. • calculates mutual inductance. • calculates $E = -Nd\emptyset/dt$ and $E = -LdI/dt$.	• How an e.m.f. is induced in a conductor • Faraday's laws of electromagnetic induction • Lenz's law • Fleming's right-hand rule for relative directions • Calculations involving $E = Blv$ and $E = Blvsin\theta$ • Description and units of self-inductance and mutual inductance • Calculations involving mutual inductance • Calculations involving $E = -Nd\emptyset/dt$ and $E = -LdI/dt$	• Guide learners to describe how an e.m.f. is induced in a conductor. • Use illustrations to explain Faraday's laws of electromagnetic induction. • Together with learners, explain Lenz's law. • Lead guided demonstrations on Fleming's right-hand rule for relative directions. • Guide learners using illustrations to calculate $E = Blv$ and $E = Blvsin\theta$ • Task learners in groups to describe and state the units of self-inductance and mutual inductance. • Lead learners' practice to calculate mutual inductance. • Guide learners using illustrations to calculate $E = -Nd\emptyset/dt$ and $E = -LdI/dt$

Assessment Strategy

- Assign learners to explain Faraday's laws of electromagnetic induction and calculate $E = -Nd\emptyset/dt$ and $E = -LdI/dt$.

Teaching and Learning Resources

- Computer
- Projector
- Sample electromagnetic circuits

Suggested References

Hayt, W. H., Kemmerly, J. E. and Durbin, S. M. (2006). Engineering Circuit Analysis. 6th Ed. McGraw-Hill, New Delhi.

Matthew, N.O. (2001). Elements of Electromagnetic. 3rd Ed. Oxford University Press.

NCCS 112: Basic Communication Skills

Duration: 45 Hours

Module Overview

This module provides learners with an opportunity to develop skills to communicate and get along with others through writing, speaking, listening, and interpreting of body language. Learners will acquire skills needed to perform business work such as inviting customers, consulting, giving the necessary advice and making simple business reports.

Learning Outcomes

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

i) communicate effectively with business stakeholders.
ii) handle correspondences at operational levels.

Sub-module1: Introduction to Communication

Duration: 4 Hours

Competence	Content	Teaching and Learning Strategy
The learner: • defines communication. • identifies the importance of communication in business. • classifies the categories of communication. • applies the different forms of communication.	• Meaning of communication • Importance of communication • Classification of communication (internal and external) • Forms of communication (formal and informal)	• Lead learners to brainstorm the definition of communication. • Group learners to discuss the importance of communication in business. • Lead a guided discussion on the types and forms of communication. • Demonstrate to learners the types of communication.

Assessment Strategy

- Task learners to identify the types and forms of communication.

Teaching and Learning Resources

- Samples of internal and external correspondences

Sub-module 2: Grammar

Duration: 6 Hours

Competence	Content	Teaching and Learning Strategies
The learner: • applies the correct grammar in speeches. • spells words correctly. • construct sentences with the right tenses. • pronounces words correctly.	• Parts of speech (nouns, pronouns, verbs, adverbs, adjectives, conjunctions and interjections) • Spellings • Tenses • Pronunciation	• Guide a discussion on the parts of speech. • Give exercises on spellings of words. • Organise a tutorial for tenses and pronunciations. • Play a cassette recording of pronunciations of words.

Assessment Strategy

i) Give learners tasks to construct sentences using nouns, verbs, adverbs and pronouns.
ii) Task learners to apply different tenses to construct meaningful sentences.

Teaching and Learning Resources

- Samples of speeches
- English dictionary
- List of nouns, pronouns, verbs, adverbs, adjectives and conjunctions
- Cassette recordings
- Cassette

Sub-module 3: Communication Process

Duration: 6 Hours

Competence	Content	Teaching and Learning Strategies
The learner: • describes the elements of communication. • develops the communication channel. • identifies barriers to effective communication. • identifies solutions to the barriers to effective communication.	• Elements of communication process • Channels of communication • Barriers to effective communication • Solution to the barriers of communication	• Illustrate to learners the communication process. • Illustrate the channels of communication. • Task learners to suggest ways of overcoming barriers to communication.

Assessment Strategy

Assess learners on:

- the communication process.
- the barriers to effective communication.

Teaching and Learning Resources

- Sender of the message
- Receiver of the message
- Radio
- Television
- Phones
- Noise

Sub module 4: Written Communication

Duration: 10 Hours

Competence	Content	Teaching and Learning Strategies
The learner: • writes business correspondences. • writes reports. • prepares memos.	• Business letters • Curriculum vitae • Business reports • Memorandum • Notices	• Guide learners on how to write business letters, notices, memos and reports. • Let learners practise written communication.

Assessment Strategy

- Give learners exercises to write business letters, memos, notices and reports.

Teaching and Learning Resources

Samples of

- Business letters
- Curriculum vitae
- Business reports
- Memorandum
- Notices
- Application letters
- Adverts
- Minutes

Sub-module 5: Oral Communication

Duration: 8 Hours

Competence	Content	Teaching and Learning Strategies
The learner: • Justifies the importance of oral communication. • Organises meetings.	• Importance of oral communicatio n • Meetings	• Use a video recording reflecting conduct of oral communication. • Organise role plays for learners to

Competence	Content	Teaching and Learning Strategies
• Negotiates for better business terms. • Makes effective public speeches.	• Negotiations • Public speeches	demonstrate meetings and negotiations. • Organise debates for learners to practice making public speeches.

Assessment Strategy

Let learners:

i) discuss the roles of a chairperson and a secretary to a meeting.

ii) make class presentations on the conduct of meetings and business negotiations.

Teaching and Learning Resources

- Video tapes
- Recorded speeches

Sub-module 6: Non-verbal Communication

Duration: 6 Hours

Competence	Content	Teaching and Learning Strategies
The learner: • applies non-verbal communication to express feelings. • interprets the non-verbal communication made by others correctly. • analyses the advantages and disadvantages of non-verbal communication.	• Types of non- verbal communication: - body language - facial expressions - gestures - postures • Eye contact • Advantages and disadvantages of non-verbal communication	• Use a video recording reflecting different non-verbal communications. • Organise role plays in which learners should emulate different non-verbal communication styles.

Assessment Strategy

- Ask learners to describe the different types of non-verbal communications.

Teaching and Learning Resource

- Video tapes

Sub-module 7: Listening

Duration: 5 hours

Competences	Content	Teaching and Learning Strategies
The learner: • justifies the importance of effective listening. • listens effectively. • identifies the causes of poor listening skills.	• Importance of listening • Barriers to effective listening	• Organise a video show on listening skills. • Conduct role-plays on the listening modes.

Assessment Strategy

- Assess learners on the listening skills by use of cassette player.

Teaching and Learning Resources

- Video tapes
- Tape recorder
- Radio cassette

Suggested References

Wardrope, W.J. And Bayless, M. L. (2009). Oral Business Communication; Instructions in Business Schools: Journal of Education for Business. Florida, Pearson's Publishing

Bovee, C. L., John, V. T. and Barbara, E. S. (2010), Business Communication Today. Tenth Ed. New Jersey, Prentice Hall

Komunda, B.M., (2005). Business Communication Skills (2nd Ed). Kampala, Mukono Printing and Publishing Company.

NCBM 113: Basic Mathematics

Duration: 45 Hours

Module Overview

This module introduces learners to the concepts of algebraic expressions, equations and inequalities, discrete structures, polynomials and rational functions, exponential and logarithmic functions.

Learning Outcome

By the end of this module, the learner should be able to solve the basic mathematical problems.

Sub-module 1: Algebraic Expressions

Duration: 8 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • evaluates real numbers and rational numbers. • illustrates indicial expressions and standard forms and notations of numbers. • develops and represents computer numbering systems. • converts computer numbering systems and illustrates their application in digital machines.	• Real numbers • Rational numbers • Indices, standard form and notation • Computer numbering systems (binary, decimal, octal, hexadecimal, their conversions and application in digital machines)	• Guide learners through illustrations to evaluate real numbers and rational numbers. • Illustrates indicial expressions and standard forms and notations of numbers. • Develops and represents computer numbering systems. • Converts computer numbering systems and illustrates their application in digital machines.

Assessment Strategy

- Give learners tasks to compute and convert computer numbering systems.

Teaching and Learning Resources

- Internet
- Calculator

Sub-module 2: Equations and Inequalities

Duration: 8 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • solves systems of linear equations'. • applies quadratic equations to solve computer related problems. • solves problems relating variations and inequalities.	• Linear equations • Application of linear equations • Quadratic equations • Applications of quadratic equations • Variations • Inequalities	• Use illustrations to guide learners in solving linear equations. • Guide learners to solve computer related problems involving quadratic equations. • Guide learners to practice solving situations/equations involving variations. • Lead learners' practice to evaluate linear and fractional inequalities.

Assessment Strategy

- Assign learners homework to solve computer problems involving equations and inequalities.

Teaching and Learning Resources

- Computer
- Graph paper
- Table of formulae
- Calculator

Sub-module 3: Discrete Structures

Duration: 12 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • solves number relating sets. • determines the domains and ranges of functions. • determines the slopes of lines and equations. • plots graphs of functions and relations.	• Sets (Venn diagrams, complements, Cartesian products, power sets) • Domains and ranges of functions • Equations of a line • Graphs of functions and relations	• Guide learners through illustrations to solve number relating sets. • Lead learners through practice to determine the domains and ranges of functions. • Guide learners on how to determine a slope of line and equations. • Guide learners to plot graphs of functions and relations.

Assessment Strategy

- Assign learners a class exercise to determine slopes of lines and equations.

Teaching and Learning Resources

- Internet
- Graph papers
- Calculators

Sub-module 4: Polynomials and Rational Functions

Duration: 12 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • simplifies and solves exponential equations. • solves	• Exponential equations • Graphing exponential functions • Simplifying logarithmic functions	• Illustrate how to solve exponential equations and task learners to practice. • Guide learners to evaluate logarithmic functions in

Competences	Content	Teaching and Learning Strategies
logarithmic functions. • writes solutions to and computes exponential growth or decay.	• Change of base • Solving logarithmic equations • Graphing logarithmic functions • Exponential growth or decay	different forms. • Lead learners through practice to determine and plot graphs for logarithmic functions. • Task learners to compute exponential growth and decay.

Assessment Strategy

- Assign learners homework to compute and plot graphs of exponential functions.

Teaching and Learning Resources

- Internet
- Logarithm table
- Calculator

Sub-module 5: Logarithms

Duration: 6 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • applies the theory of logarithms to solve logarithmic functions. • use logarithm tables to solve equations involving log functions.	• Theory of logarithms • Common logarithms • Equations involving logarithmic functions	• Illustrate the theory of logarithms. • Guide learners through practice to apply the theory of logarithms to solve logarithmic functions. • Use logarithm tables to solve equations involving log functions.

Assessment Strategy

- Assign learners homework to solve logarithms using the theory of logarithms and logarithmic tables.

Teaching and Learning Resources

- Logarithm table
- Internet
- Calculator

Suggested References

Barry, S. and Bradley, S. (2010). Technical Math for Dummies. (Auflage Ed). UK. John Wiley and Sons Ltd.

Blair, K. A. s and, Vincent, K. (2012). Mathematics for Technicians. 7th Ed. Europe, McGraw-Hill Education.

Dekking, F. M et al (2007). A Modern Introduction to Probability and Statistics: Understanding Why and How. 1st Ed. UK. Springer London Ltd.

Glyn, J. (2015). Modern Engineering Mathematics. 5th New Ed. Pearson Education Limited

Haym, K. et al (2009). Basic Mathematics. With Applications to Science and Technology. (2nd Ed). Europe, McGraw-Hill Education

Howe, J. et al (2010). "Ten Flags." Mathematics Teaching in the Middle School .16.2 72-75.

John, B. (2005). Basic Engineering Mathematics. Fifth Ed. Elsevier Ltd

John, B. (2014). Understanding Engineering Mathematics. Worked Solutions to Exercises. Fifth Ed. Elsevier Ltd

John, B. and May, A. J. (1994). Technician Mathematics, Volume 3. Longman Scientific & Technical.

Paul. J. N. (2014). Inside Interesting Integrals. Springer-Verlag New York Inc.

Stroud, K.A. (2013). Engineering Mathematics. 7th Edition. UK. MacMillan Education

NCCM 113: Real Life Project 1

Contact Hours: 60

Module Overview

This module introduces the learner to projects in construction, repair and maintenance of computers.

Learning Outcome

By the end of this module, the learner should be able to carry out a project related to Computer Maintenance and Repair.

Sub-module 1: Introduction to Real Life Projects

Duration: 10 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • justifies the importance of real life projects. • designs and writes an effective project proposal.	• Meaning of real life project • Importance of real life project • Preparations for undertaking a real-life project • Selection of a viable real life project	• Task learners to brainstorm the meaning and importance of real life project. • Use examples to demonstrate the nature of real life projects. • Guide learners through the criterion for selection of a suitable project and the preliminary preparations required before execution.

Sub-module 2: Real Life Project 1

Duration: 50 Hours

Competence	Content	Teaching and Learning Strategies
The learner selects and executes a project from various areas.	**Suggested projects** • Development of Job Cards • Creating Ms. Access tool to track repair jobs and customers and preparing reports • Preparing personal documentation and ICT documentation. • Any other viable project	• Guide learners in selection of projects to do. • Task learners to execute the selected projects.

Teaching and Learning Resources

- Internet for research
- Old computer components
- Toolkits
- Power source

Suggested References

Elena, A. (2016). *The Application of Projects Methods in Training Students in Secondary Vocational Education.* Olympiáda techniky Plzeņ. https://otik.uk.zcu.cz/bitstream/11025/21421/1/Artemieva.pdf

Project Report of Computer Shop Management: https://www.scribd.com/doc/266737244/Project-Report-on-Computer-Shop-Management-System

Project Computer Sales and Service Centre (2): https://www.scribd.com/doc/94974615/Project-Computer-Sales-and-Service-Centre-2

Modules Description of Year 1 Semester 2

NCCM 121: Operating System Software

Duration: 75 Hours

Module Overview

This module introduces learners to the management and manipulation of the operating system software.

Learning Outcome

By the end of this module, the learner should be able to manage and manipulate the computer operating system software.

Sub-module 1: Introduction to Operating Systems

Duration: 6 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • illustrates the operating system (OS) design diagram. • demonstrates how the OS boots the computer. • describes the functionality of the operating system. • analyses the features and comparisons of the open and closed source operation system .	• Operating system design diagram • How OS boots the computer • Operating system functionality • Open vs. closed source OS.	• Guide learners through illustrations on the OS design diagram. • Lead practical demonstrations on how the OS boots the computer. • Guide learners to describe the functionality of the OS. • Lead a guided discussion for learners to analyse the features and comparisons of the open and closed source operation systems.

Assessment Strategy

- Assign the learners to research on the features and comparisons of the open and closed source operation systems and make reports.

Teaching and Learning Resources

- Internet
- Computer
- Projector

Sub-module 2: How the Operating System Controls other Functions

Duration: 6 Hours

Competence	Content	Teaching and Learning Strategies
The learner describes the operating system controls on the different computer functions.	• Software resources • Memory allocation and all peripheral devices • Common services to computer application software	• Guide learners to discuss the operating system controls on software resources. • Use simulations to demonstrate how the operating system controls memory allocation and all peripheral devices. • Guide the learners to discuss the common services to computer application software.

Assessment Strategy

- Assign the learners to research on how the operating system controls memory allocation and all peripheral devices and make write-ups.

Teaching and Learning Resources

- Internet
- Computer
- Projector
- Simulations

Sub-module 3: Describing Operating Systems Adaptability

Duration: 8 Hours

Competence	Content	Teaching and Learning Strategy
The learner describes the adaptability features of the operating system.	• Multi-user • Multitasking • Multiprocessing • Multithreading	• Guide learners through demonstrations and simulations to describe the adaptability features of the operating system.

Assessment Strategy

- Assign the learners to research on the adaptability features of the operating system and make presentations.

Teaching and Learning Resources

- Internet
- Computer
- Projector
- Simulations

Sub-module 4: Operating System and Processor Architecture

Duration: 6 Hours

Competence	Content	Teaching and Learning Strategy
The learner illustrates the operating system processor architecture.	• 32 bit • 64 bit • 32 – 64 bit	• Guide learners to identify and describe the features of the different OS processor architecture.

Assessment Strategy

- Assign the learners to research on other features of the OS processor architecture and make class presentations.

Teaching and Learning Resources

- Internet
- Computer
- Projector
- Simulations

Sub-module 5: Desktop Operating Systems

Duration: 8 Hours

Competence	Content	Teaching and Learning Strategies
The learner describes the features and benefits of the different desktop operating systems.	• Microsoft Windows • Apple Mac OS • Linux	• Using demonstrations, lead an in-depth description of the features of each desktop operating system. • Guide learners to discuss the benefits and challenges of each desktop operating system.

Assessment Strategy

- Assign the learners to discuss the benefits and challenges of each desktop operating system and make write reports.

Teaching and Learning Resources

- Internet
- Computer
- Projector
- Simulations

Sub-module 6: Network Operating Systems

Duration: 8 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • describes the characteristics of network operating systems. • analyses the different network operating systems resources to computers. • identifies the different examples of network operating systems	• Characteristics of network operating systems • Network operating systems resources to computers • Examples of network operating systems	• guide learners' discussions to describe the characteristics of network operating systems. • lead learners through demonstrations to analyse the different network operating systems resources to computers. • task learners to identify the different examples of network operating systems.

Assessment Strategy

- Assign the learners homework to make write-ups on features of the different network operating systems.

Teaching and Learning Resources

- Internet
- Computer
- Projector
- Simulations

Sub-module 7: Operating Systems Installation

Duration: 18 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • describes the OS compatible applications and environments. • describes the minimum hardware requirements and compatibility with OS platform. • checks for OS compatibility. • upgrades Windows OS. • applies the Windows user state migration tool (USMT) to migrate data. • identifies and describes the different types of storage devices. • partitions hard drives. • describes the different file systems.	• OS compatible applications and environments • Minimum hardware requirements and compatibility with OS platform • Checking OS compatibility • Windows OS upgrades • Data migration: the windows user state migration Tool (USMT) • Storage device types • Hard drive partitioning • File systems	• Guide learners to describe the OS compatible applications and environments. • Task learners to identify and describe the minimum hardware requirements and compatibility with OS platform. • Use demonstrations to guide learners to check for OS compatibility and upgrades windows OS. • Task learners to apply the windows user state migration tool (USMT) to migrate data. • Lead learners' discussions to identify and describe the different types of storage devices. • Assign learners in groups to partition hard drives under your guidance. • Lead a guided group discussion to describe the different file systems in a computer.

Assessment Strategy

- Assign the learners to apply the windows user state migration tool (USMT) to migrate data and partition hard drives in their personal computers.

Teaching and Learning Resources

- Internet
- Computer
- Projector
- Simulations
- Engineering Mathematics Fifth edition by John Bird

Suggested References

Bacon J [and Harris T], Addison Wesley 1997 [2003]. Concurrent Systems or Operating Systems.

IT Fundamentals/operating Systems.
https://en.wikiversity.org/wiki/IT_Fundamentals/Operating_Systems

Leffler, S. J. and Addison, W. (1989). The Design and Implementation of the 4.3BSD UNIX Operating System

Silberschatz, A., et at (1998). Operating Systems Concepts (5th Ed.)

Solomon, D. and Russinovich, M, Microsoft Press 2000 [2005]. Inside Windows 2000 (3rd Ed) or Windows Internals (4th Ed)

YouTube: 32-bit vs 64-bit Computers & Phones:
https://www.youtube.com/watch?v=IknbgnJLSRY

YouTube: Diagnose Windows Problems Using the Event Viewer:
https://www.youtube.com/watch?v=3FAfM469WSQ

YouTube: Introduction to Operating Systems:
https://www.youtube.com/watch?v=MzVGL44eq9w

YouTube: IT Fundamentals - Software:
https://www.youtube.com/watch?v=JZ-iGCmLWv4

YouTube: Operating Systems 1:
https://www.youtube.com/watch?v=5AjReRMoG3Y

YouTube: What is an Operating System:
https://www.youtube.com/watch?v=pVzRTmdd9j0

YouTube: What is Open Source Explained in LEGO:
https://www.youtube.com/watch?v=a8fHgx9mE5U

YouTube: What is Open Source?:
https://www.youtube.com/watch?v=QfXkxkybQ4Q

NCCM 122: Applied Mathematics for Technicians

Duration: 60 Hours

Module Overview

Mathematics is fundamental to the study of Computing. It provides the necessary analytical skills for the study of more advanced subjects such as electronics, discrete mathematics and for the design of algorithms, among others. Applied Mathematics for Technicians is an edifice of computing and is as such crucial for Computing.

Learning Outcomes

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

i) solve mathematical problems using computational tools.
ii) derive mathematical models of physical systems.
iii) solve differential equations using appropriate methods.
iv) present mathematical solutions in a concise and informative manner.

Sub-module 1: Matrices and Determinants

Duration: 12 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • performs matrix analysis. • adds, subtracts and multiplies matrices. • performs calculations on the determinant and inverse of matrices. • determines the solutions of simultaneous equations using	• Matrix notation • Addition, subtraction and multiplication of matrices • The determinant and inverse of matrix • Solution of simultaneous equations by matrices and determinants	• Lead a guided discussion on matrix analysis approaches. • Guide learners through illustrations to add, subtract and multiply matrices. • Perform a calculation on the determinant and inverse of matrices. • Lead learners' practice on solutions of simultaneous equations

Competences	Content	Teaching and Learning Strategies
matrices, determinants and Cramer's rule.	• Solution of simultaneous equations using Cramer's rule	by matrices and determinants and how to solve matrices using Cramer's rule.

Assessment Strategy

- Assign learners to solve problems of simultaneous equations using matrices, determinants and Cramer's rule.

Teaching and Learning Resources

- Computer
- Projector
- Determinants and Cramer's rule

Sub-module 2: Complex Numbers

Duration: 12 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • solves Cartesian complex numbers. • uses the Argand diagram to plot complex numbers. • adds and subtracts complex numbers. • multiplies and divides complex numbers. • evaluates complex equations. • evaluates the polar form of a complex number. • carries out multiplication and division of complex numbers in polar	• Cartesian complex numbers • The Argand diagram • Addition and subtraction of complex numbers • Multiplication and division of complex numbers • Complex equations • The polar form of a complex number • Multiplication	• Lead a guided discussion on Cartesian complex numbers and the Argand diagram. • Guide learners to solve Cartesian complex numbers. • Guide learners to use the Argand diagram to plot complex numbers. • Use illustrations to guide learners in addition and subtraction of complex numbers. • Lead learners' practice to multiply and divide complex numbers. • Task learners to analyse and evaluate complex equations and the polar form of a complex number. • Guide learners through

Competences	Content	Teaching and Learning Strategies
form. • describes the applications of complex numbers.	and division in polar form • Applications of complex numbers	practice to carry out multiplication and division of complex numbers in polar form. • Lead group discussions to describe the applications of complex numbers.

Assessment Strategy

- Assign learners to evaluate complex equations and the polar form of a complex number and describe the engineering applications of complex numbers.

Teaching and Learning Resources

- Computer
- Projector
- Tutorials on plotting and evaluation of complex numbers

Sub-module 3: Trigonometric Functions

Duration: 11 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • explains trigonometry and the theorem of Pythagoras. • calculates trigonometric ratios of acute. • evaluates fractional and surd forms of trigonometric ratios. • solves the angle of elevation and depression.	• Trigonometry • The theorem of Pythagoras • Trigonometric ratios of acute • Fractional and surd forms of trigonometric ratios • Angle of elevation and depression	• Lead a guided discussion on Trigonometry and the theorem of Pythagoras. • Guide learners to perform calculations on trigonometric ratios, fractional and surd forms of trigonometric ratios. • Lead learners through practice to solve angle of elevation and depression.

Assessment Strategy

Assign the learners to solve problems involving:

i) trigonometric ratios, fractional and surd forms of trigonometric ratios.
ii) angle of elevation and depression.

Teaching and Learning Resources

- Computer
- Projector
- Objects with angles
- Online tutorials on trigonometric functions

Sub-module 4: Differentiation

Duration: 13 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • analyses differentiation. • performs differentiation of trigonometric functions and exponential functions. • performs the different methods of differentiation.	• Introduction to differentiation • Differentiation of trigonometric functions and exponential functions • Methods of differentiation	• Lead a guided discussion to analyse differentiation. • Guide learners through practice to perform calculations on functional notation, the gradient of a curve, differentiation of trigonometric functions and exponential functions. • Lead learners through illustrations on the different methods of differentiation.

Assessment Strategy

- Assign the learners to solve problems involving functional notation, the gradient of a curve, differentiation of trigonometric functions and exponential functions.

Teaching and Learning Resources

- Computer
- Projector
- Sample documentation on differential equations
- Online tutorials on evaluation of differential equations

Sub-module 5: Integration

Duration: 12 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • analyses integration. • performs differentiation of trigonometric functions and exponential functions. • performs the different methods of differentiation.	• Standard integration • Integration using algebraic substitutions • Integration using trigonometric substitutions	• Lead a guided discussion on the process of integration, the general solution of integrals, standard integrals and definite integrals. • Perform calculations involving standard integrals and definite integrals. • Lead learners through a discussion on how to perform an integration using algebraic substitutions. • Lead learners through a discussion on how to perform an integration using trigonometric substitutions.

Assessment Strategy

- Assign the learner to solve problems involving integration using algebraic and trigonometric substitutions.

Teaching and Learning Resources

- Computer
- Projector
- Sample documentation on integral analysis
- Online tutorials on evaluation of differential equations

Suggested References

Blair, K. A. and Vincent, K. (2012). Mathematics for Technicians. 7th Edn. Europe, McGraw-Hill Education -

Dekking, F. M at el (2007). A Modern Introduction to Probability and Statistics: Understanding Why and How. 1st Edn. UK. Springer London Ltd.

Glyn, J. (2015). Modern Engineering Mathematics. 5th New Edn. Pearson Education Limited

Haym, K., Moore J. T. and Ramon, A. M. (2009). Basic Mathematics. With Applications to Science and Technology. (2nd Edn). McGraw-Hill Education - Europe

Howe, J. H. and Badillo, J. A. (September 2010). "Ten Flags." Mathematics Teaching in the Middle School .16.2 72-75.

John, B. (2010). Basic Engineering Mathematics. Fifth Edn. Elsevier Ltd

John, B. (2014). Understanding Engineering Mathematics. Worked Solutions to Exercises. Fifth Edn. Elsevier Ltd

John, B. and Joy, A.C. (1994). Technician Mathematics, Volume 3. Longman Scientific & Technical.

K.A. Stroud (2013), Engineering Mathematics. 7th Edn. UK. MacMillan Education.

Nahin, P.J. (2014). Inside Interesting Integrals. New York Inc. Springer-Verlag

Schoenborn, B and Simkins, B. (2010). Technical Math for Dummies. (Auflage Edn). UK, John Wiley and Sons Ltd.

NCCA 124: Computer Applications

Duration: 60 Hours

Module Overview

This module introduces learners to the use of computers. It provides learners with basic knowledge and skills to familiarise with the use and working of computers using different modern information communication technologies. They will acquire hands-on experience in Microsoft office applications such as Word processing, Spread sheet, Database applications, publication and the use of internet resources. These will enable them to digitally access, process, store and disseminate information.

Learning Outcome

By the end of the module, the learner should be able to use and manipulate a computer to prepare documents and search web based information from the Internet.

Sub-module 1: Introduction to Computer

Duration: 8 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • identifies the origin of computers. • describes the types of computers • describes the components of a computer. • boots and shuts a computer. • identifies the computer hardware. • identifies the computer software. • observes the need for computers. • identifies the dangers of using	• Origin of computers • Types of computers • Components of a computer • Starting a computer • Shutting down a computer • Computer hardware • Computer software; (Video card, network cards, ROM, RAM, cameras, processors)	• Lead a guided discussion on the origin computers. • Display components of a computer for learners to identify their functions. • Guide learners through practice to start and close a computer. • Demonstrate the use of the different components of a computer. • Let learners demonstrate the removal and replacement of computer RAMS. • Guide learners to use the keyboard to manipulate the typing techniques.

Competences	Content	Teaching and Learning Strategies
computers. • provides safety and security of a computer.	• Importance of a computer • Dangers of using computers • Safety and security of a computer	• Lead a guided discussion on the uses and dangers of computers. • Guide learners through practice to implement the safety and security measures of a computer.

Assessment Strategy

- Assign learners to identify and sort out computer hardware components according to their application.

Teaching and Learning Resources

- Computer
- External drives
- Keyboard
- Mouse
- Memory cards
- RAM sets
- CPU
- Monitor/screen
- UPS
- Power cables
- Power source

Sub-module 2: Operating System

Duration: 6 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • classifies the computer operating systems. • describes the operation of the computer system. • identifies the benefits of using the computer operating systems. • installs and uninstalls windows	• Types and classification of operating systems • Functions of an operating system • Benefits of operating systems • Installation of windows operating	• Assign learners to research on the types and classifications of operating systems and make class presentations. • Lead a guided discussion on computer operating system and its functions. • Guide learners through a discussion on types, classification and benefits of computer operating system.

Competences	Content	Teaching and Learning Strategies
operating system, application software and other support programmes.	system and application software	• Demonstrate the procedure of installing and uninstalling operation system and other support computer programmes.

Assessment Strategy

- Give learners assignments to install and uninstall the computer operating system.

Teaching and Learning Resources

- Computers with installed operating system

Sub-module 3: Desktop Main Menu

Duration: 6 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • locates the desktop start menu. • creates desktop background and screen saver. • identifies icons on desktop and their application. • resizes windows. • maximises and minimises windows to task pane. • closes and opens windows from task pane.	• Start menu • Applications menu • Working with the desktop background and screen saver • Icons, files and folders • Manipulating open windows; resizing, maximising, minimising task pane, and tiling windows	• Guide learners through practice to locate desktop start menu. • Guide learners through practice to create desktop background and screen saver from default settings. • Demonstrate the application of various icons on desktop and allow learners to practice. • Demonstrate the resizing, minimising and maximising of open windows.

Assessment Strategy

Assign learners to:

i) create desktop background and screen saver from default settings and pictures or photographs saved in the computer.

ii) apply the different icons of the computer to produce documents.

Teaching and Learning Resources

- Functioning computers
- Monitors/screens
- Power

Sub-module 4: Word Processing

Duration: 12 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • starts, creates or opens a Word window. • works with texts and manages files. • uses Word menus to typeset and edit documents. • formats documents. • saves documents to a different storage media.	• Starting, creating and opening a Word window • Working with texts • Word menus for document editing; e.g. copy, paste, cut • Saving a Word document • Formatting a page, document and paper size • Working with tables • Working with drawings, clipart and pictures	• Guide learners to open new documents and work with texts to manage files. • Guide learners through practice to use Word menus for document editing; e.g. copy, paste, cut. • Guide learners through demonstrations and practise to save a document in different formats and to a storage media, e.g. flash disc. • Demonstrate the formatting of a page and documents for learners to practice.

Assessment Strategy

- Give learners an assignment to type documents and save on the desktop.

Teaching and Learning Resources

- Computers
- Power source
- Power cable
- Monitor

Sub-module 5: Printing, Scanning and Copying Documents

Duration: 4 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • installs a printer to the computer. • describes the procedure followed when printing documents. • inserts tonner in the printer. • prints documents. • scans documents. • observes security and safety precautions during printing and scanning of documents.	• Installing a printer • Working with printer cartridges and toners • Printing documents • Scanning documents and pictures • Safety, security and health precautions when printing and scanning documents	• Guide learners through practice to install the printer to a computer. • Guide learners on the insertion of tonners into a printer. • Demonstrate the printing of a document. • Guide learners through practice to scan and copy documents. • Guide learners to observe security and safety precautions when printing and scanning documents.

Assessment Strategy

- Give learners tasks to type and print documents.

Teaching and Learning Resources

- Working computers
- Power source
- Printer
- Scanner
- Tonner / cartridge

Sub-module 6: Microsoft Excel

Duration: 8 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • creates an excel document. • enters data in a spreadsheet. • edits and formats spreadsheet information. • applies excel formulae to calculate figures. • draws charts, tables, and graphs using excel icons. • prints excel documents.	• Creating an excel document • Entering data to a spreadsheet, editing and formatting a datasheet • Using formulas and functions • Creating/plotting charts and graphs from excel data values • Inserting tables to excel worksheet • Printing a spreadsheet	• Guide learners through practice to create excel documents. • Give learners tasks to enter data in excel sheets. • Guide learners through practice to calculate using excel formulae. • Demonstrate the insertion of tables, charts, and graphs in excel documents.

Assessment Strategy

- Give learners a test to enter data in excel sheets and apply the formulae for addition and multiplication to calculate figures.

Teaching and Learning Resources

- Computers
- Power source
- Samples of excel documents
- Printer

Sub-module 7: Internet and Email

Duration: 8 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • connects to an internet website. • surfs information from the internet, downloads and saves information from the internet. • creates a strong password for the email address. • creates an email address. • creates an email password. • connects two computers in one room to a LAN. • sends messages through emails. • downloads messages received through emails. • observes the health, safety, and security precautions when using the internet.	• The Internet, web browsers • Opening a website; website address • Internet surfing and search engines • Saving information from the Internet, downloading files, music, pictures to the computer • Electronic mail: - Creating email account - Email folders and attachments - Attaching documents to outgoing email - Downloading email attachment - Formatting mail - Searching mail • Health, safety and security precautions when using the Internet and email.	• Demonstrate the connections to internet websites. • Guide learners through practice to browse information from the Internet. • Guide learners to save downloaded information. • Demonstrate the creation of an email account and password. • Give learners tasks to write and send messages through emails, with an attachment. • Lead a guided discussion on the security, safety and health practices to be observed when using the Internet and email.

Assessment Strategy

Give learners exercises to:

i) open email addresses.

ii) write and send to each other electronic mails.

Teaching and Learning Resources

- Computers
- Internet connections

Sub-module 8: Basic Networking

Duration: 8 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • connects to wireless and cable networks. • communicates through the local area networks (LAN) and wide area network (WAN). • troubleshoots simple network connection problems. • connects a printer to a network.	• Introduction to computer networking • Types of network WAN and LAN • Types of communication media; cables, wireless, optic fibres • Connecting a computer to a network • Troubleshooting simple connection problems • Connecting and configuring a printer to a network	• Lead a guided discussion on the types of networks. • Guide learners to connect to both cable and wireless networks. • Demonstrate the procedure of networking and allow learners to practice. • Demonstrate the installation and disconnection of a network computer and modem. • Guide learners to troubleshoot network problems.

Assessment Strategy

- Give learners assignments to send messages through LAN.

Teaching and Learning Resources

- Internet router
- Data cable
- Computer
- Local area network connections

Suggested References

Bazi, M., Baguma, I. & Anjoga, H. (2007). Unmasking Information Communication Technology. 1st Edn, Kampala, Uganda.

Mugivane, F. (2004). Introduction to Computer. Advatech Office Supplies Ltd. Nairobi

Microsoft Word 2013 Part 1 Introduction to Word, Free PDF Tutorial for Beginners Users. https://www.computer-pdf.com/office/word/619-tutorial-microsoft-word-2013-part-1-introduction.html

Moya, M. and Nyeko, S. (2009). Information and Communication Technology in Business. 1st Edn.

Saleemi, N.A. (1997). Electronic Data Processing Simplified. Nairobi, N.A Saleemi Publishers.

Sanjay, S. (2010). A First Course in Computers, 2nd Edn. New Delhi, Vikas Publishing House

NCED 125: Elements of Entrepreneurship Development

Duration: 60 Hours

Module Overview

This module will equip learners with creative and innovative skills and ability to look out for opportunities by manipulating the natural and man-made resources into business. It is intended to make the learners develop a positive career attitude towards entrepreneurship as a means of making a living. It covers units concerning creativity and innovation, scanning the environment for business opportunities, planning a business, managing a business, and entrepreneurial ethics.

Learning Outcomes

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

i) generate business ideas.
ii) identify viable business opportunities.
iii) mobilises business resources.
iv) start and manage a business.

Sub-module 1: Concepts of Entrepreneurship

Duration: 6 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • defines entrepreneur and entrepreneurship. • observes the qualities of an entrepreneur. • identifies the types of entrepreneurs and what they do. • justifies the roles of entrepreneurs in the community. • describes entrepreneurship process.	• Entrepreneur and entrepreneurship • Characteristics/ qualities of an entrepreneur • Types of entrepreneurs • Roles of an entrepreneur • Entrepreneurship process • Barriers to entrepreneurship	• Let learners brainstorm the differences between entrepreneur and entrepreneurship. • Let learners discuss in groups the qualities of a good entrepreneur and make presentations. • Lead a guided discussion on the types and roles of entrepreneurs in the community. • Illustrate the process followed by entrepreneurs to create

Competences	Content	Teaching and Learning Strategies
• identifies the barriers to entrepreneurship development.	development	business. • Guide learners on the barriers to entrepreneurship development.

Assessment Strategy

- Give learners group work to discuss the characteristics and qualities of a good entrepreneur.

Sub-module 2: Creativity and Innovation

Duration: 10 Hours

Competences	Contents	Teaching and Learning Strategies
The learner: • distinguishes between creativity and innovation. • demonstrates the characteristics of a creative person. • analyses the types and causes of innovation. • identifies barriers to creative and innovation thinking. • justifies the benefits of innovation to small businesses. • generates business ideas for setting up a business.	• Distinction between creativity and innovation • Characteristics of a creative person • Types of innovation • Causes of innovation • Characteristics of innovative people • Barriers to creative and innovation thinking • Benefits of innovation to small business • Sources of business ideas	• Let learners brainstorm on the differences between creativity and innovation. • Give learners tasks to research on the characteristics of creative and innovative persons. • Lead a guided discussion on the barriers to creative thinking. • Group learners to discuss the benefits of innovation in business and make classroom presentations. • Guide a brainstorming session on the sources of business ideas.

Assessment Strategy

i) Task learners to discuss in groups barriers to creativity and how to overcome them.

ii) Give learners homework to discuss the characteristics of an innovative person.

Sub-module 3: Business Opportunities

Duration: 8 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • identifies business opportunities. • screens business opportunities to select the most appropriate. • analyses the forms of businesses. • sets up a business based on the analysis and decisions made. • looks out for causes of businesses success/failure.	• Identifying business opportunities • Screening business opportunities • Forms of business ownership (sole proprietorship and partnership) • Establishing a business • Reasons for success/failure of businesses	• Assign learners to identify business opportunities in their communities. • Let learners make a presentation of the identified business opportunities so as to screen out the most viable ones. • Let learners discuss the requirements for starting up a business. • Lead a guided discussion on the forms of business ownership.

Assessment Strategy

i) Let learners discuss the different forms of business ownership.
ii) Give learners assignments on the causes of business success and failure.

Sub-module 4: Small Scale and Medium Enterprises (SMEs)

Duration: 10 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • identifies the sources of business idea. • observes the characteristics	• Definition of SME • Sources of business ideas • Characteristics of small scale enterprises	• Lead a discussion on the sources of business ideas. • Let learners brainstorm the characteristics of small scale enterprises. • Lead a guided discussion

Competences	Content	Teaching and Learning Strategies
of SMEs and their sources of capital. • analyses the challenges faced by SMEs and the remedies to the challenges.	• Sources of capital to small scale enterprises • Importance of small scale businesses • Challenges faced by small scale businesses in Uganda • Remedies to the challenges	on the sources of capital for small scale enterprises. • Give learners an assignment to research on the challenges faced by small scale enterprises and suggest remedies to the challenges identified.

Assessment Strategy

- Organise a field study on the importance and challenges faced by small and medium scale enterprises.

Sub-module 5: Business Planning

Duration: 10 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • makes a business plan. • justifies the importance of a business plan. • identifies the challenges involved in making a business plan. • observes the role of government in entrepreneurship development.	• Structure of a business plan • Uses of a business plan • Mobilising business resources • Challenges of planning a business • Government role in entrepreneurship development	• Illustrate to learners the different structures of a business plan. • Ask learners to draw a business plan for their projects. • Let learners make classroom presentations on the challenges encountered in preparing a business plan. • Lead a guided discussion on the role of government in entrepreneurship development.

Assessment Strategy

- Task learners to prepare a simple business plan.

Teaching and Learning Resource

Samples of business plans

Sub-module 6: Managing a Business

Duration: 10 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • scans the environment within which to run a business. • identifies the risks involved in managing a business. • sets measures to sustain competition in business. • exhibits good leadership skills to promote implementation of the business plans.	• Business environment • Business risks • Sustaining competitiveness of a business • Leadership and motivation in a business	• Lead a discussion on how to manage a business in a changing environment. • Invite an industrialist to guide learners on the risks involved in business and how to sustain competitiveness. • Demonstrate the best leadership styles for learners to emulate.

Assessment Strategy

Give learners:

i) assignment to describe the macro and micro business environment.

ii) homework to analyse the leadership styles, power and motivation of an entrepreneur.

Sub-module 7: Entrepreneurship Ethics

Duration: 6 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • appreciates the importance of entrepreneurship ethics. • identifies the roles of ethics in entrepreneurship. • describes the ethical challenges facing entrepreneurs. • identifies solutions to ethical challenges.	• Introduction to entrepreneurship ethics • Importance of entrepreneurship ethics • Ethical challenges facing entrepreneurs • Solution to ethical challenges	• Guide group discussions on the importance and roles of ethics in entrepreneurship. • Guide a brainstorming session on ethical challenges facing entrepreneurs and how to overcome them.

Assessment Strategy

- Task learners to discuss in groups the importance and role of ethics in entrepreneurship.

Teaching and Learning Resources

- Business magazines
- Compendiums about entrepreneurs
- Free publicity and promotional materials
- Government publications
- Journal articles
- Newspaper articles
- Proceedings of conferences
- Consortium of entrepreneurship educators website

Suggested References

Blackburn, R. (2008). "Small Business and Entrepreneurship". doi:10.4135/9781446263433. ISBN 9781412934374.

Bowman, E. (2011). Entrepreneur Training Manual, Third Edn. Certified Entrepreneur Workbook. Guanzi Institute Press. ISBN 978-0-9837862-9-0.

Bruder, J. (2013). "The Psychological Price of Entrepreneurship." Inc. (Winner 2014 Annual Awards Contest of the Deadline Club)

Brychan, T., Miller, C. & Lyndon, M., (2011). Innovation and Small Businesses, Vol.1. London. BookBoon Publishers

Dana, L. P. (2010). "Nunavik, Arctic Quebec: Where Co-operatives Supplement Entrepreneurship," Global Business and Economics Review 12 (1/2), January 2010, pp. 42–71.

Deakins, D.; Freel, M. S. (2009). "Entrepreneurial Activity, the Economy and the Importance of Small Firms". Entrepreneurship and Small Firms. McGraw-Hill Education. ISBN 978-0-07-712162-4.

Duening, T. N.; Hisrich, R. A.; Lechter, M. A. (2009). Technology Entrepreneurship: Creating, Capturing and Protecting Value. Academic Press. ISBN 978-0-08-092288-1.

Foo, M.D. (2011). "Emotions and Entrepreneurial Opportunity Evaluation". Entrepreneurship Theory and Practice. 35 (2): 375–393.

Greg, B. (2006), Six Sigma for Small Business. Texas, Entrepreneur Press.

James, W. H. (2014). Your Small Business Adventure: Finding Your Niche and Growing a Successful Business. ALA/Huron Street Press. ISBN 978-1-937589-44-8.

Kuratko, (2008). The Emergence of Entrepreneurship Education: Development, Trends and Challenges. 9th Edn

Leitão, J.; Baptista, R. (2009). Public Policies for Fostering Entrepreneurship: A European Perspective. Springer Science Business Media. ISBN 978-1-4419-0249-8.

Lundstrom, A.; Stevenson, L. A. (2005). Entrepreneurship Policy: Theory and Practice. Springer. ISBN 978-0-387-24140-1.

Miller, K. (2005). Communication Theories: Perspectives, Processes, and Contexts (2nd ed.). New York, McGraw-Hill.

Minniti, M.; Moren, L. (2010). "Entrepreneurial Types and Economic Growth". Journal of Business Venturing. 25 (3): 305–314. doi:10.1016/j.jbusvent.2008.10.002.

Rea, C. and Volland, N. (2015). The Business of Culture: Cultural Entrepreneurs in China and Southeast Asia. 1900-65. UBC Press. ISBN 9780774827829.

Robin, L. and Sue, M. (2006). Enterprise: Entrepreneurship and Innovation: Concepts, Contexts and Commercialization. Butterworth-Heinemann. ISBN 978-0750669207.

Scheufele, D.; Moy, P. (2000). Twenty-five Years of the Spiral of Silence: A Conceptual Review and Empirical Outlook. International Journal of Public Opinion Research. 12. pp. 3–28. doi:10.1093/ijpor/12.1.3. ISSN 0954-2892.

Shane, S. (2013). "The Genetics of Entrepreneurial Performance". International Small Business Journal. 31 (5): 473–495. doi:10.1177/0266242613485767.

Shane, S.; Venkataraman, S. (2000). "The Promise of Entrepreneurship as A Field of Research". Academy of Management Review. 25 (1): 217–226. doi:10.5465/amr.2000.2791611. JSTOR 259271.

Srivastava S.B.; (2001). A Practical Guide to Industrial Entrepreneurs. New Delhi. Sultan Chand & Sons

Timmons, J. A & Spinelli, S. (2003). New Venture Creation and Entrepreneurship for the 21st Century, 6th Edn. Boston, McGraw-Hill

Zahra, S. A. (2009). "A Typology of Social Entrepreneurs: Motives, Search Processes and Ethical Challenges". Journal of Business Venturing. 24 (5): 519–532. doi:10.1016/j.jbusvent.2008.04.007.

Zhang, S.X.; Cueto, J. (2015). "The Study of Bias in Entrepreneurship". Entrepreneurship Theory and Practice. 41 (3): 419–454. doi:10.1111/etap.12212.

NCCM 123: Real Life Project 2

Duration: 60 Hours

Module Overview

This module will develop the learner's ability to implement basic electric circuits using breadboards. It will aid the learner to create simple series circuits, parallel circuits and combination of the two connections. It will also help the learners to develop the skill of installing operating systems (Windows) and carry out OS maintenance.

Learning Outcome

By the end of this module, the learner should be able create and repair simple circuits and install, troubleshoot and maintain windows operation systems.

Competences	Content	Teaching and Learning Strategies
The learner: • creates circuits. • installs windows OS. • troubleshoots windows installation. • updates, patches and configures security settings. • backs-up systems. • sets restore points.	• Creating circuits • Installing windows OS • Troubleshooting windows installation • Updating, patching and configuring security settings • Backing-up systems • Setting restore points	• Guide learners to select appropriate projects. • Supervise learners during the execution of their projects and offer professional guidance. • Analyse learners' report writing and give guidance where necessary.
Sample Projects • Creation of circuits • Documentation of experiment and analysis of circuits. • Installation and troubleshooting of windows OS: updating, patching, security, recovery. • Any other project in modules content areas of first year.		

Teaching and Learning Resources

- Computers
- Sample project reports
- Electronics systems
- windows OS
- Maintenance toolkit

Suggested References

Elena, A. (2016). The Application of Projects Methods in Training Students in Secondary Vocational Education. Olympiáda techniky Plzeņ. https://otik.uk.zcu.cz/bitstream/11025/21421/1/Artemieva.pdf

Project Report of Computer Shop Management: https://www.scribd.com/doc/266737244/Project-Report-on-Computer-Shop-Management-System

Project Computer Sales and Service Centre (2): https://www.scribd.com/doc/94974615/Project-Computer-Sales-and-Service-Centre-2

NCCM 124: Industrial Training 1

Duration: 388 Hours (6 weeks)

Competences	Content	Teaching and Learning Strategies
The learner: • puts in practice the skills and knowledge acquired in class. • demonstrates ability to manage computer hardware and software.	**Suggested areas of training** • Using MS office applications to input and printout information • Creating circuits • Installing windows operating system. • Troubleshooting windows installation • Updating, patching and configuring security settings • Backing-up systems • Setting restore points • Applying safety measures when handling ICT equipment • Demonstrating effective communication skills	• Lead a guided discussion on the Industrial Training guidelines. • Guide learners on how to use logbooks (daily activity record books). • Guide learners on how to write Industrial Training reports • Guide a discussion on the required professional behaviour and communication skills during Industrial Training.

Assessment Strategy

i) Field supervisors scores the candidate according to the attached Industrial Training Guidelines

ii) Academic supervisor visits the field to observe the trainee performance, also interviews the field supervisor about the trainee's performance.

Teaching and Learning Resources

- Telephone contact/address of the trainees
- Industrial Training placements
- Industrial Training Assessment Forms
- Trainees' Logbooks/ record books
- Sample Industrial Training reports
- Computers
- ICT workshops and gadgets/equipment
- Electric and electronic circuits
- Maintenance toolkits

Modules Description of Year 2 Semester 1

NCCM 211: PC Maintenance Tools and Devices

Duration: 75 Hours

Module Overview

This module introduces the learner to specification, maintenance, troubleshooting, repair and assembly of electronic and telecommunication circuits and systems.

Learning Outcomes

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

i) interpret and test the characteristics of the electronic devices.
ii) diagnose the faults, repair and maintain electronic devices, and equipment.

Sub-module 1: Specifications

Duration: 10 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • describes the purpose of specification. • identifies and describes the different types of specification. • interprets the test specification for a particular system in order to ensure satisfactorily level of quality operation.	• Purpose of specifications • Types of specifications • Preparation for a test specification • Working on a test specification • Concept of failure rate in troubleshooting and repair of electronic	• Demonstrate to learners the role of the various administrator tools. • Brainstorm the purpose of specification. • Guide learners to identify and describe the different types of specification. • Guide learners to practice interpretation of the test specifications for a particular system to confirm satisfactory level of quality operation.

Competences	Content	Teaching and Learning Strategies
• identifies the correct equipment, device system or product suitable for certain operation. • describes reliability and factors affecting equipment reliability. • identifies the relationship between reliability and cost. • applies the concept of failure rate in troubleshooting and repair of electronic equipment. • uses the cost of reliability to select a reliable component or system for use. • identifies the exponential law of reliability. • maintains and repairs systems by replacing worn out components.	equipment • Exponential law of reliability • Maintenance and repair of systems	• Assign learners different operations and task them to identify the correct equipment, device system or product suitable for executing them. • Task learners in groups to describe reliability and the factors affecting equipment reliability. • Lead a guided discussion on the relationship between reliability and cost. • Guide learners to analyse the concept of failure rate and apply it in troubleshooting and repair of electronic equipment. • Guide learners to select a reliable component or system for use basing on the cost of reliability. • Guide learners to practice maintenance and repair of systems through replacement of worn out components.

Assessment Strategy

- Give learners an assignment to carry out maintenance and repair of specific systems by replacing worn out components.

Teaching and Learning Resources

- Computer
- Projector
- Internet
- Faulty computer systems

Sub-module 2: Reliability

Duration: 12 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • describes the various terms relating to reliability. • identifies and describes the factors affecting equipment reliability. • describes the relationship between reliability and cost. • discusses the equipment and system failure rate, MTTF and MTBF. • demonstrates the exponential law of reliability. • analyses the environmental effects on reliability. • describes the relationship between quality and reliability.	• Definitions relating to reliability • Factors affecting equipment reliability • Relationship between reliability and cost • Cost involved in selecting a reliable component or system for use • Failure rate, MTTF and MTBF • The exponential law of reliability • Environmental effects on reliability • Relationship between quality and reliability	• Task learners to describe the terms relating to reliability. • Guide learners to identify and describe the factors affecting equipment reliability. • Task learners in groups to describe the relationship between reliability and cost. • Lead a class discussion on the equipment and system failure rate, MTTF and MTBF. • Demonstrate the exponential law of reliability. • Use demonstrations to describe the exponential law of reliability. • Lead a class discussion to analyse the environmental effects on reliability • Lead learners' group discussions to describe the relationship between quality and reliability.

Assessment Strategy

- Assign learners to carry out research on the environmental effects on reliability and conduct class presentations to analyse the findings.

Teaching and Learning Resources

- Faulty computer systems

Sub-module 3: Data Presentation, Distribution and Sampling

Duration: 10 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • draws frequency diagrams. • calculates arithmetic mean, standard deviation, normal distribution, confidence limits and experimental errors. • draws distribution curves. • applies binomial distribution to determine the probability that an item is correct or incorrect in a sample.	• Frequency diagram • Calculation of arithmetic (mean) • Measurement of scatter • Standard deviation • The normal distribution • Estimation of experimental error • Confidence limits • Sampling	• Guide learners to define and draw frequency diagrams. • Lead learners' practice through illustrations to calculate arithmetic mean, standard deviation, normal distribution, confidence limits and experimental errors. • Task learners to draws distribution curves. • Guide learners' practice to apply binomial distribution in determining the probability that an item is correct or incorrect in a sample.

Assessment Strategy

- Assign learners to apply binomial distribution to determine the probability of an item being correct or incorrect in a sample.

Teaching and Learning Resources

- Binomial distribution tables
- Sample distribution curves
- Computer
- Projector
- Internet connection

Sub-module 4: Measurement and Measuring Instruments

Duration: 18 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • defines measuring, measurement. • identifies the basic electrical measuring instruments. • categorises the different measuring instruments. • differentiates between analogue and digital measuring instruments. • states the advantages and disadvantages of analogue and digital measuring instruments. • describes units of measurements. • increases the range of measuring instruments. • measures and takes readings of electrical quantities. • tests electronic circuits using testing equipment (signal generator, oscilloscopes and	• Definition of the basic terms • Basic electrical measuring instruments • Categories: analogue and digital measuring instruments • Advantages and disadvantages of analogue and digital measuring instruments • Moving coil instruments • Increasing the range of measuring instruments • Measuring electrical quantities • Testing equipment:	• Brainstorm the definition of measuring and measurement. • Guide a brainstorming session to identify the basic electrical measuring instruments. • Guide learners to categorises the different measuring instruments. • Task learners in groups to; differentiate between analogue and digital measuring instruments; and state their advantages and disadvantages. • Use illustrations to describe the units of measurements. • Guide learners through demonstrations to increase the range of measuring instruments. • Task learners in groups to measure and take readings of electrical quantities. • Lead learners through practice to test electronic

Competences	Content	Teaching and Learning Strategies
multi-meter) and repairs electronic faults in a system. • determines the performance/efficiency of electronics machines.	- signal generator - multi meters - cathode-ray oscilloscopes • Performance/ efficiency of electronics machines	circuits and carryout repairs of electronic faults in the system. • Task learners in groups to determine the performance/efficiency of electronic machines.

Assessment Strategy

- Give learners exercise to test electronic circuits and carryout repairs of electronic faults in the system.

Teaching and Learning Resources

- Electronic circuits
- Signal generator
- Multi meters
- Cathode-ray oscilloscopes
- Computer
- Faulty electronic systems

Sub-module 5: System Maintenance and Fault Diagnosis

Duration: 12 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • defines maintenance. • describes the procedures taken while carrying out maintenance. • applies the principles of maintenance to	• Meaning of maintenance • Maintenance principles • Maintenance procedures • Locating faults in systems	• Brainstorm the meaning of maintenance. • Guide learners through demonstrations to describe the procedures taken while carrying out maintenance. • Lead learners through practice to apply the

Competences	Content	Teaching and Learning Strategies
repair in the shortest period of time. • appropriately uses and maintains test instruments. • locates faults in the system.	• System fault finding aids •	principles of maintenance in repairing of electronic equipment. • Task learners in groups to use and maintain test instruments during fault finding in systems.

Assessment Strategy

- Assign learners to carry out tests, locate faults and perform the required tests on specific electronic systems.

Teaching and Learning Resources

- Maintenance tool kit
- Faulty electronic systems
- Computer
- Projector
- Internet

Sub-module 6: Acoustic Devices and Equipment

Duration: 13 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • defines acoustic devices and equipment. • identifies, acoustic devices and equipment. • operates and repairs acoustic devices and equipment. • troubleshoots electronic	• Meaning of Acoustic Devices • Types of Acoustic Devices and equipment • Introduction to transducers • Microphone types • Loudspeakers, head phones and ear pieces • Troubleshooting, repair and	• Brainstorm the meaning of acoustic devices and equipment. • Guide learners to identify acoustic devices and equipment. • Lead learners through practice to operate and repair acoustic devices and equipment. • Guide learners through demonstrations to carry out troubleshooting of

Competences	Content	Teaching and Learning Strategies
circuits of acoustic devices and equipment using system fault finding aids (test instrument, circuit diagrams, and manuals).	maintenance of acoustic devices and equipment	electronic circuits of acoustic devices and equipment using system fault finding aids to include; testing instruments, circuit diagrams and manuals.

Assessment Strategy

- Assign learners practical exercises to troubleshoot specific electronic circuits of acoustic devices and equipment.

Teaching and Learning Resources

- Working and faulty acoustic devices and equipment
- Computer
- Projector

Suggested References

Basic Computer Maintenance. **https://www.computer-pdf.com/architecture/710-tutorial-basic-computer-maintenance.html**

Computer Architecture. https://www.computer-pdf.com/architecture/75-tutorial-programme -computer-architecture.html

Computer Basics. https://www.computer-pdf.com/other/5-tutorial-programme -computer-basics-tutorial.html

Jean, A. (2016). *CompTIA A+ Guide to I*T Technical Support + Lab Manual. 9th Edn. Programme Technology Ptr.

Mike, M. (2007). Guide to Managing and Troubleshooting PCs. Second Edn. McGraw-Hill, Inc. New York.

Mik, M.(2016), Managing and Troubleshooting PCs, Fifth Edn. McGraw-Hill Education

NCCM 212: Electronic Communication and Networks

Duration: 60 Hours

Module Overview

This module, introduces the learners to the basics of data communications and networks. It also gives the theoretical and practical skills of linking up computers and sharing computer resources.

Learning Outcome

The learner demonstrates data flow in a simple network, design a network, terminate cables and configure a network connection.

Sub-module 1: Introduction to Networks

Duration: 20 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • evaluates the relevancy of network. • identifies and uses different network components. • classifies various network connections. • understands and punches various types of connector. • identifies different LAN topologies. • assigns IP addresses to network component.	• Meaning of networks: - advantages - disadvantages of networks • Network components - Node, NIC and modem - Access point - Hub (active & passive) - Repeaters & bridge - Switch & routers • Network cables connectors: - RJ-45 - BNC - db9 serial pinout - DB-25(parallel) • Classification of networks: - LAN - Topologies (ring, star, bus and hybrid) - WLAN (Wi-Fi and Bluetooth) - WAN • IP addressing and sub-netting.	• Brainstorm the advantages and disadvantages of network • Lead a guided discussion to identify the components of a computer network while classifying. • Guide learners to classify the various network connections. • Guide learners on how to examine • the use of the different connectivity device. • Demonstrate the punching of various types of cable connectors. • Lead learners in identifying and describing the different LAN and WAN topologies. • Demonstrate to the learners how to sub-net and configure IP addresses.

Assessment Strategy

i) Learners do assignment on classification of networks.
ii) Task learner to punch a cat 6 or cat 5 cable and test it.
iii) Let learner connect the punched cables to an Ethernet card.
iv) Task learners to assign IP addresses to the network printer and workstations.
v) Task learners to evaluate computer networks.

Teaching and Learning Resources

- Networking software
- Packet tracer
- Working computers
- Network cards
- Switch device
- Crimping tool

Sub-module 2: Transmission Media and Components

Duration: 16 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • identifies and explains the different transmission media. • lays out various cables and uses them appropriately. • works on guided and unguided/wireless data transmission. • analyses transmission impairments occurrence and describes how to overcome such errors in analog and digital transmission.	• Difference between analog and digital signals • Forms of data transmission - Simplex - Half duplex - Full duplex • Layout of various cables and their usage: - Coaxial cable - Twisted pair cable (Cat 5, Cat 6) - Straight through - Cross-over - Fibre optic cable • Wireless media systems - Terrestrial microwaves - radio waves - Satellite - Wireless communication - Transmission impairments and errors - Analog and digital data transmission	• Lead a guided discussion on the uses of the different forms of data transmission. • Use samples to discuss the role of the different network cables. • Lead a guided discussion on the unguided media and their uses. • Take learners through transmission impairments occurrence, how to overcome such errors in analog and digital transmission.

Assessment Strategy

i) Task learners to identify the different network cables and their uses.

ii) Task learners to suggest application areas of unguided media system.

Teaching and Learning Resources

- Videos / demos/ simulations/ manuals
- Computers
- Demonstration software
- Projector
- Network cables
- Networking tool box with crimping tool
- Internet connectivity

Sub-module 3: Internet Connectivity

Duration: 8 Hours

Competence(s)	Content	Teaching and Learning Strategies
The learner: • identifies services offered by the Internet. • discusses the disadvantages of the Internet. • connects to the Internet. • creates an email account. • sends and receives electronic messages. • searches for information using search engines. • applies the internet terminologies.	• Services offered by the Internet • Disadvantages of the Internet • Sending and receiving an email. • Searching for information on the Internet. • Network terminologies: - Peer-to-peer network - Server base network - Hybrid network - Data - Bandwidth - Uploading - Downloading	• Brainstorm the services offered by the Internet. • Lead discussions on the disadvantages of the Internet. • Guide learners on how to connect to the Internet and create an email account. • Illustrate to the learners how to send and receive messages. • Guide learners' practice to search for information using search engines. • Task learners to describe and apply the Internet terminologies. • Guide learners on how to apply cyber ethics.

Assessment Strategy

- Task learner to create an email account. Let them search for information on the Internet and send to the teacher's email.

Teaching and Learning Resources

- Computers
- Internet connectivity

Sub -module 4: Basics of Operating System Software

Duration: 12 Hours

Competence(s)	Content	Teaching and Learning Strategies
The learner: • Describes: - Client end/window - 32 bits and 64 bits OS - FAT-16/32, NTFS, • Configures disks • Prepares partitions and volumes • Installs/upgrades and troubleshoots windows operating system.	• Client end/window • 32 bits and 64 bits OS • FAT-16/32, NTFS, • Configuration of disks • Preparing partitions and volumes • Configurations of device drivers • Install / upgrade / troubleshoot operating system	• Guide learners to describe: - Client End/Window - 32 bits and 64 bits OS - FAT-16/32, NTFS • Guide learners to configure disks. • Lead learners to practice preparing partitions and volumes. • Guide learners on how to install/upgrade and troubleshoot windows operating system software.

Assessment Strategy

- Task learners to install and upgrade Windows 7 on the end user computer.

Teaching and Learning Resources

- Windows 7 with SP3
- Computers
- Demos / videos manuals

Sub-module 5: Network Security

Duration: 4 Hours

Competences	Content	Teaching and Learning Strategy
The learner: • evaluates network risks and threats. • implements access controls to the network.	• Network threats: creating user accounts and regulating access • Setting passwords and encrypting files	• Lead a guided discussion about the network risks and threats. • Guide learners on how to create user accounts on the network. • Guide learner on how to administer access controls information on network resources.

Assessment Strategy

i) Task learners to identify information threats on networks.
ii) Task learners to encrypt and descript information.

Teaching and Learning Resources

- Files
- Encrypting software

Sub-module 6: Administrator Tools

Duration: 8 Hours

Competences	Content	Teaching and Learning Strategy
The learner: • describes the roles of various client end/window administrative tools. • manages various tasks and utilities on the local area network.	• Client end/window • User accounts • Event viewer • Performance monitor • Task scheduler • Windows firewall/ defender • Diagnostic tools • Network configuration	• Guide learners through demonstrations to access the different client end/window administrator tools and discuss the roles of each.

Assessment Strategy

- Task learners to create user accounts and assign access controls.

Teaching and Learning Resources

- Windows 7/Windows 8
- Driver Pack 15
- Computers
- Demos / videos manuals

Suggested References

Agrawal, M. (2010). Business Data Communications. John Wiley & Sons, Inc. p. 37. ISBN 0470483369.

Cisco (2011). What is Network Security? Retrieved from cisco.com

Comer (2000). Glossary of Internetworking Terms, p.686: Term Encapsulation.

Comer (2000). Protocols are to Communication what Algorithms are to Computation. Sect. 1.3 - Internet Services, p. 3

Dale, T./Greg A. (2006). Security Threat Mitigation and Response: Understanding CS-MARS. Cisco Press.

Deploying Zone-Based Firewalls, Ivan Pepelnjak, Cisco Press, Oct. 5, 2006.

Douglas, E. C. (2000). Internetworking with TCP/IP - Principles, Protocols and Architecture (4th ed.). Prentice Hall. ISBN 0-13-018380-6.

Douglas, E. Comer (2000). Internetworking with TCP/IP - Principles, Protocols and Architecture (4th Edn.). Prentice Hall. ISBN 0-13-018380-6.

Duane D,(2006).Self-Defending Networks: The Next Generation of Network Security. Cisco Press.

Gary, H./Greg, K. (2007). Security Monitoring with Cisco Security MARS. Cisco Press.

Hansell, C.W., U.S. Patent 2,389,432, "Communication System by Pulses through the Earth".

Network Infrastructure Security, Angus Wong and Alan Yeung, Springer, 2009.

Network Security: PRIVATE Communication in a PUBLIC World, Charlie Kaufman | Radia Perlman Mike Speciner, Prentice-Hall, 2002. ISBN.

SC Magazine (2014). Network Clarity. Case Study

Securing Your Business with Cisco ASA and PIX Firewalls, Greg Abelar, Cisco Press, May 27, 2005.

NCCM 213: Computer Ethics

Duration: 45 Hours

Module Overview

This module is a new branch of ethics that will enable the learners to demonstrate ethical behaviour in the field of information and communication technology that is growing and developing rapidly.

Learning Outcomes

By the end of this module, the learner should be able to describe the importance of ICT ethical behaviours and observe computing ethics while carrying out professional duties.

Sub-module 1: Introduction to Information Communication Technology Ethics

Duration: 12 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • describes the meaning and different forms of ICT ethics. • applies the different categories of ethical behaviours when using the computer. • describes the importance ICT of ethical behaviour to users.	• Meaning of ethics • Forms of ICT ethics • The ethics of using computers between the person and the same • The ethics of using computers between the persons • Ethics between the user and device • Importance of ethical behaviour to a user	• Brainstorm the meaning of ethics and the different ICT ethics. • Brainstorm the unethical behaviours of computer users in society. • Lead a guided discussion on the forms of ICT ethics. • Lead a guided discussion on the importance of ethical behaviours to different users.

Assessment Strategy

- Assign learners to research on the importance of ICT ethical behaviours to single users and to organisations, and make presentations.

Teaching and Learning Resources

- Videos manuals
- Documents on ethical code of conduct

Sub-module 2: Scenarios of Computer Misuse and Effects to Society

Duration: 8 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • analyses the effects of a computer misuse. • identifies the effects of computer misuse.	• Media/software piracy • Intellectual property theft • Ransom ware attacks • Identity theft • Financial theft • Pornography	• Lead a guided discussion on situations involving computer misuse. • Brainstorm with the learners about the effects of computer misuse.

Assessment Strategy

- Assign learners to identify and make a write-up discussion on the different scenarios of computer misuse and their effects to society.

Teaching and Learning Resources

- Computers
- Overhead projector
- Internet
- Demos / videos manuals
- Documents on ethical code of conduct

Sub-module 3: Forms of Computer Software Attacks

Duration: 8 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • identifies threats to computer software. • documents the software attacks for mitigation. • mitigates cyber threats systematically.	• Attack form • Viruses • Worms • Trojan horses • Denial of service • Brute force • Steps to mitigate cyber risks.	• Lead a guided discussion on the various software attacks. • Brainstorm the methods of mitigating the threats caused by the software attacks. • Lead a guided discussion on the 5 steps to mitigate cyber threats.

Assessment Strategy

- Assign learners specific cyber risks and task them to write a description of the steps they would follow to mitigate the risks.

Teaching and Learning Resources

- Demos / videos manuals
- Documents on ethical code of conduct

Sub-module 4: Ethical Challenges in Information Technology

Duration: 8 Hours

Competence	Content	Teaching and Learning Strategies
The learner identifies the ethical challenges encountered in information technology.	• Security • Privacy issues • Copyright infringement • Increased pressure on information technology experts • Digital divide	• Lead a guided discussion on each of challenges encountered in information technology giving examples. • Task learners to establish solutions to each of the challenges.

Assessment Strategy

- Assign learners to research and make class presentations on the solutions to each of the challenges encountered in information technology.

Teaching and Learning Resources

- Demos / videos manuals
- Documents on ethical code of conduct

Sub-module 5: Ethical Code of Conduct in Computer Work

Duration: 9 Hours

Competence	Content	Teaching and Learning Strategies
The learner applies the 10 commandments of computer ethics.	• The 10 commandments of computer ethics • Importance of a cyber-law	• Lead a guided discussion on the 10 commandments of computer use. • Brainstorm the importance cyber laws in Uganda.

Assessment Strategy

- Assign learners to research on the importance of a cyber-law in Uganda and make reports.

Teaching and Learning Resources

- Computers
- Internet
- Demos / videos manuals
- Documents on ethical code of conduct

Suggested References

American Philosophical Association's Newsletter on Philosophy and Computers: https://en.wikipedia.org/wiki/American_Philosophical_Association

Bynum, T. W. (2000). The Foundation of Computer Ethics. ACM SIGCAS Computers and Society.

Bynum, T. "Computer Ethics: Basic Concepts and Historical Overview". In Zalta, Edward N. Stanford Encyclopedia of Philosophy: https://plato.stanford.edu/entries/ethics-computer/

Coleman, K. G. "Computing and Moral Responsibility". In Zalta, Edward N. Stanford Encyclopedia of Philosophy: https://plato.stanford.edu/entries/computing-responsibility/

Ethics in Computing - a list of links to ethical discussions in Computer Science courtesy of North Carolina State University Undergraduates with guidance from Dr. Edward F. Gehringer: http://ethics.csc.ncsu.edu/

Floridi, L. (1999). Information Ethics: On the Theoretical Foundations of Computer Ethics (PDF). Ethics and Information Technology.

Floridi, L.; Sanders, J.W. (2002). "Computer Ethics: Mapping the Foundationalism Debate" (PDF). Ethics and Information Technology.

Haag, S.; Cummings, M.; McCubbrey, D. J. (2003). Management Information Systems: For the Information Age (4th ed.). New York: McGraw-Hill. ISBN 978-0-07-281947-2.

IEG, the Information Ethics Research Group at Oxford University: http://web.comlab.ox.ac.uk/oucl/research/areas/ieg/

Johnson, D. G. (2001). Computer Ethics (3rd ed.). Upper Saddle River, NJ: Prentice Hall. ISBN 978-0-13-083699-1.

MacKinnon, B. (2011). Ethics: Theory and Contemporary Issues (7th ed.). Belmont, CA: Wadsworth. ISBN 978-0-538-45283-0.

Martin, C. D.; Weltz, Elaine, Y. (June 1999). "From Awareness to Action: Integrating Ethics and Social Responsibility into the Computer Science Curriculum". ACM SIGCAS Computers and Society.

Moor, J. H. (1985). What is Computer Ethics? In Bynum, Terrell Ward. Computers & Ethics. http://rccs.southernct.edu/what-is-

computer-ethics/#what-is-computer-ethics: Blackwell. ISSN 0026-1068.

Mowshowitz, A. (1981). On Approaches to the Study of Social Issues in Computing. Communications of the ACM.

Quinn, M. J. (2011). Ethics for the Information Age (4th ed.). Boston, MA: Addison-Wesley. ISBN 978-0-13-213387-6.

Stamatellos, G. (2007). Computer Ethics: A Global Perspective. Jones and Bartlett. ISBN 978-0-7637-4084-9.

Tavani, H. T. (2004). Ethics & Technology: Ethical Issues in an Age of Information & Communication Technology. Hoboken, NJ: John Wiley and Sons. ISBN 978-0-471-24966-5.

The International Journal of Cyber Ethics in Education (IJCEE): http://www.igi-global.com/ijcee

The Research Center on Computing & Society: http://www.southernct.edu/organizations/rccs/

NCCM 214: Computer Systems Architecture and Logic

Duration: 60 Hours

Module Overview

This module introduces the logical architecture and organisation of computer systems. It highlights the lower end operations in a typical computer as well as the way computers manage their resources during operation. The module opens up the learner to be an informed user rather than a passive recipient of the computer services.

Learning Outcomes

By the end of the module, the learner should be able to:

i) operate a simple microprocessor.
ii) exhibit practical skills in prototyping digital circuits as well as interfacing digital circuits to microprocessor systems.

Sub-module 1: Data Representation and Logic Gates

Duration: 20 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • illustrates the different formats of data representation in the computer. • constructs and analyses logic gates.	• Representation of data: bits; bytes; integer formats, binary, octal and hexadecimal systems, fixed (signed magnitude, ones and twos complement), floating point formats, BCD formats, alphanumeric codes • Conversion of numerals to binary • Logic gates	• Guide learners through illustrations to represent computer data in different formats. • Guide learners to convert numerals to binary from other numerical systems. • Lead learners' guided practice to construct and analyse logic gates.

Assessment Strategy

- Assign the learners to construct and analyse logic gates.

Teaching and Learning Resources

- Computer
- Projector
- Internet

Sub-module 2: Micro Computer Architecture

Duration: 14 Hours

Competence	Content	Teaching and Learning Strategy
The learner describes and illustrates the microcomputer architecture.	• CPU and its components (ALU, CU, registers) • Memory • I/O devices and interfaces • System bus • Examples of CPU structures, machine language instructions, instruction formats and addressing modes • Sets: instruction fetch, decode and execute • Clock speed	• Guide learners through illustrations to describe and demonstrate the microcomputer architecture.

Assessment Strategy

- Assign the learners to research and describe the microcomputer architecture.

Teaching and Learning Resources

- Computer
- Projector
- Internet

Sub-module 3: The Processing Elements

Duration: 8 Hours

Competence	Content	Teaching and Learning Strategies
The learner demonstrates the operational features of the different processing elements.	• Macro instruction execution • Internal bus transfers • Detailed internal architecture • Micro-control • Hardwired control • Micro-programmed control • Reduced instruction set computers	• Guide learners through demonstrations to describe the operational features of the different processing elements.

Assessment Strategy

- Assign the learners to describe the operational features of the different processing elements.

Teaching and Learning Resources

- Computer
- Projector
- Internet

Sub-module 4: Input / Output (I/O) Programming

Duration: 10 Hours

Competence	Content	Teaching and Learning Strategy
The learner carries out the various input/output programming processes.	• Programmed I/O • Interrupt I/O • Polling • Priority interrupt system • Direct memory access • I/O processors	• Guide learners through practice to perform the input/output programming processes.

Assessment Strategy

- Assign the learners to research and make a descriptive report on the input/output programming processes.

Teaching and Learning Resources

- Computer
- Projector
- Internet
- I/O simulations and tutorials

Sub-module 5: Memory Systems and Memory Management

Duration: 8 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • describes the various memory systems. • illustrates the different memory management hardware.	• Memory hierarchy • Main memory • Auxiliary memory • Associative memory • Cache memory • Virtual memory • Memory management hardware	• Guide learners to describe the various memory systems. • Use illustrations to guide learners in describing the different memory management hardware.

Assessment Strategy

- Assign the learners homework to describe the operational features of the different memory management hardware.

Teaching and Learning Resources

- Computer
- Projector
- Internet

Suggested References

Andrew, S. T. (1984). Structured Computer Organisation. Prentice Hall
Glenn, B. G. (1991). Computer Systems Concepts and Design. Prentice Hall
Morris, M. (1993). Computer Systems Architecture. Prentice Hall
William, S. (2003). Computer Organization and Architecture. Prentice Hall

NCCM 213: Real Life Project 3

Duration: 60 Hours

Module Overview

This module will develop the learner's ability to install windows OS, lay data cables, rectify faults in logic circuits and maintain electronics systems and acoustic devices/equipment.

Learning Outcome

By the end of this module, the learner should be able install windows OS, lay data cables, rectify faults in logic circuits and maintain electronics systems.

Competences	Content	Teaching and Learning Strategies
The learner: • installs, upgrades and troubleshoots windows OS. • lays data transmission cables. • diagnoses and rectifies faults of malfunctioning combinational logic circuits. • maintains acoustic devices and equipment. • maintains electronics systems and diagnoses faults.	Sample Projects • Installation, upgrading and troubleshooting of windows OS • Laying data transmission cables • Diagnosis and rectification of faults of malfunctioning combinational logic circuits • Maintenance of acoustic devices/equipment • Maintenance of electronics systems and diagnoses of their faults	• Guide learners to select appropriate projects. • Supervise learners during the execution of their projects and offer professional guidance. • Analyse learners' report writing and give guidance where necessary.

Teaching and Learning Resources

- Computers
- Logic circuits
- Sample project reports
- Electronics systems
- Windows OS
- Maintenance toolkit

Suggested References

Elena, A. (2016). *The Application of Projects Methods in Training Students in Secondary Vocational Education.* Olympiáda techniky Plzeň. https://otik.uk.zcu.cz/bitstream/11025/21421/1/Artemieva.pdf

Project Computer Sales and Service Centre (2): https://www.scribd.com/doc/94974615/Project-Computer-Sales-and-Service-Centre-2

Project Report of Computer Shop Management: https://www.scribd.com/doc/266737244/Project-Report-on-Computer-Shop-Management-System

Modules Description of Year 2 Semester 2

NCCM 221: Programming Language Fundamentals (C++)

Duration: 75 Hours

Module Overview

This module is intended to create a strong base in the principles and practice of functional programming. A high level programming language like C++ is to be used. Students are to cover both theoretical principles and hands-on practical skills. The main concepts to cover include program structure, data structures, syntactical and semantic correctness, planning and segmentation in programming.

Learning Outcomes

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

i) describe how computing uses or benefits from programming fundamentals.
ii) identify the appropriate paradigm for a given programming problem.
iii) use a suitable programming language to implement, test, and debug algorithms for solving simple problems.

Sub-module 1: Introduction to C++

Duration: 6 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • describes the theory of object oriented programming and its techniques. • describes the advantages and disadvantages of object oriented	• Introduction to the theory of the object oriented programming, advantages and disadvantages • Characteristics of C++ programming language	• Lead a guided discussion on the theory of the object oriented programming, its advantages and disadvantages. • Lead a guided discussion on the

Competences	Content	Teaching and Learning Strategies
programming. • describes the characteristics of C++ and its capabilities.	• Capability of C++ language – portability • Procedural (modular) and structural nature of C++ programming	characteristics of C++ and its capabilities.

Assessment Strategy

Assign the learners to:

i) discuss the advantages and disadvantages of object oriented programming.

ii) describe the characteristics of C++ and its capabilities.

Teaching and Learning Resources

- Computer system
- Projector
- Friedman
- Online tutorials
- Wand and Haynes

Sub-module 2: Evolution of Programming Languages

Duration: 4 Hours

Competence	Content	Teaching and Learning Strategies
The learner demonstrates an understanding of machine languages e.g. low level languages and high level languages with examples.	• Machine language, low level language e.g. assembly programming language, high level programming language	• Lead a guided discussion on the machine language. • Lead a guided discussion on the high level and low level language and illustrate with examples.

Assessment Strategy

- Assign the learners homework to discuss the difference between low level language and high level language.

Teaching and Learning Resources

- Computer system
- Projector
- Friedman
- Online tutorials
- Wand and Haynes

Sub-module 3: Solving a Problem on a Computer

Duration: 20 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • demonstrates the 6 key steps in an overview for solving a problem on a computer. • designs a solution strategy for the problems. • writes the computer program correspondin g to the algorithm. • demonstrates the various program development methods and programming	• Defining the problem • The steps in solving the problem • Developing an algorithm (a method) for solving the problem • Writing the computer program corresponding to the algorithm • Testing and debugging the program • Documenting the program • Designing a solution strategy: developing an algorithm • Comparing and contrasting various methods of	• Guide learners using demonstrations, through the 6 key steps in an overview to include: - defining the problem - analysing the problem - developing on algorithm (a method) for solving the problem - writing the computer program corresponding to the algorithm - testing and debugging the program - documenting the program (write an explanation of how the program works and how to use it) • Lead learners through the process of designing a solution strategy: - developing an algorithm - determining definition and properties of an algorithm

Competences	Content	Teaching and Learning Strategies
paradigms (top down design vs. bottom up design)	representing an algorithm i.e. natural languages, flow charts, etc • Writing the computer program corresponding to the algorithm • Program development methods and programming paradigms (top down design vs. bottom up design)	- Comparing and contrasting various methods of representing an algorithm i.e. Natural languages, flow charts. • Guide learners in groups to write the computer program corresponding to the algorithm. • Guide learners to practice the program development methods and programming paradigms (top down design vs. bottom up design).

Assessment Strategy

- Assign learners homework to write a computer program that corresponds to a specific algorithm.

Teaching and Learning Resources

- Computer system
- Projector
- Sample computer programmes
- Internet

Sub-module 4: The "Hello World" Program

Duration: 6 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • explains and compares "Hello world" program statements and	• Explanation and comparison of statements i.e. libraries used, inbuilt functions (main (), print f(),	• Guide learners to make explanations and comparisons of statements i.e. libraries used, inbuilt functions (main (), print f(), and

Competences	Content	Teaching and Learning Strategies
other syntax rules. • demonstrates input/output practical examples. • describes the integrated development/ Programming environment. • writes the basic syntax.	and other syntax rules implemented). • More I/O practical examples (*Console Input/ Output: print f(), scan f(), getchar() and putchar(), getch() and getche()*) • The integrated development/ C programming environment • Basic syntax	other syntax rules implemented). • Guide learners to identify and demonstrate more I/O practical examples (*Console Input/ Output: printf(), scanf(), getchar() and putchar(), getch() and getche()*). • Guide learners to describe the integrated development/ C programming environment. • Lead learners to practice writing basic syntax.

Assessment Strategy

- Assign learners to write basic syntax of a programme.

Teaching and Learning Resources

- Computer system
- Projector
- Sample Hello world programme
- Internet

Sub-module 5: Data Types, Variables and Constants

Duration: 8 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • identifies and modifies the basic data types. • declares variables. • defines variable	• Data type: basic data types, modifying basic types • Variables and constants • Declaration of	• Guide learners to identify and modify the basic data types. • Guide learners through demonstrations on how to declare variables and define variable names.

Competences	Content	Teaching and Learning Strategies
names. • performs initializing of variables. • defines the different storage classes and constants.	variables and variable names • Initialising variables • Storage classes and constants	• Lead learners' practice to perform initialising of variables. • Task learners in groups to define the different storage classes and constants.

Assessment Strategy

- Assign learners to perform initialising of variables in a programme.

Teaching and Learning Resources

- Computer system
- Projector
- Internet

Sub-module 6: Expressions and Operators in C++

Duration: 8 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • writes expressions and operators used in C++ programming. • illustrates the precedence of operators.	• Arithmetic operators • Assignment operators • Relational operators • Logical operators • Increment and decrement operators • Conditional operators • Bitwise operators • Size of operator • Special operators • Type casting • Precedence of operators	• Guide learners using demonstrations to write the different expressions and operators used in C++ programming. • Lead learners through practice to illustrate the precedence of operators.

Assessment Strategy

- Assign learners to write at least five expressions and operators used in C++ programming.

Teaching and Learning Resources

- Computer system
- Projector
- Programme variables and constants

Sub-module 7: Statements in C++

Duration: 8 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • writes decision-making statements. • writes and explains the C++ iteration statements.	• Decision statements: - if statement - if...else statement - nested if statements - if - else - if ladder - the break and switch statement • Iteration statements: - for statement - while statement - do while - nested loops - the infinite loop - loop control statements	• Guide learners using illustrations to develop decision statements such as: if statement, if...else statement, nested if statements, if - else - if ladder, the break and switch statement. • Lead learners to practice the use of iteration statements to include: for statement, while statement, do while, nested loops, the infinite loop, loop control statements.

Assessment Strategy

- Assign learners to write decision statements and iteration statements for C++ programme.

Teaching and Learning Resources

- Computer system
- Projector
- Statements in C++ programme

Suggested References

Bjarne, S. (2000). The C++ Programming Language. Addison-Wesley, ISBN 0-201-70073-5

Chuck, E. (2003). C++ Programming Fundamentals. Charles River Media, ISBN 158402371

Herbert, S. (2003). C++ from the Ground Up. Third Edition, McGraw Hill/Osborne, ISBN 0-07-222897-0

NCCM 222: Digital Electronics

Duration: 60 Hours

Module Overview

This module introduces the learner to mathematical language used in digital electronics, description of Boolean algebra and logic gates used to implement Boolean functions.

Learning Outcomes

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

i) interpret and simplify logic expressions.
ii) calculate and convert into different bases.
iii) solve, design and construct digital electronic circuits.

Sub-module 1: Introduction to Number Systems and Codes

Duration: 12 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • represents number systems of decimal, binary, octal and hexadecimal. • performs number systems conversions of decimal, binary, octal and hexadecimal number systems. • represents decimal numbers using the Binary coded Decimal (BCD) . • describes the difference between the BCD and straight binary.	• Number system conversions of decimal, binary, octal and hexadecimal • Code system: BCD	• Lead learners through a guided discussion on number system conversions of decimal, binary, octal and hexadecimal. • Illustrate number system representation and conversions of decimal, binary, octal and hexadecimal. • Lead learners through a guided discussion on BCD. • Illustrate conversion of BCD to decimal.

Assessment Strategy

Assign the learners to:

- participate in the discussion on number system conversion of decimal, binary, octal and hexadecimal.
- convert decimal, binary, octal and hexadecimal.
- attempt an assignment on conversion of BCD to decimal.

Teaching and Learning Resources

- Scientific calculator
- Computer
- Internet

Sub-module 2: Logic Gates and Boolean algebra

Duration: 18 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • identifies different basic logic gates symbols. • calculates the number of outputs of two and three inputs logic gates. • derives a truth table of two and three input logic gates. • derives a truth table of a simple combinational circuit containing at least three different logic gates. • uses Boolean operation of OR, AND, NAND and NOT in the simplification of	• Basic gates symbols • Operation and constructi on of the truth table for the AND, NAND, OR, NOR and NOT gates • Boolean operation for AND, OR, and NOT • Describing logic circuits algebraica lly	• Lead a guided discussion on the identification of the representation of different basic logic gates. • Lead learners through a guided discussions on derivation of truth tables of NOT, AND, NAND and OR. • Illustrate how to obtain truth tables of different logic gates of NOT, AND, NAND and OR. • Illustrate how to determine the output wave form of the different logic gates of NOT, AND, NAND and OR. • Lead the learners through a guided discussion on derivation of truth tables of a simple combination of at least three different logic gates of NOT, AND, NAND and OR. • Lead the learners through a guided discussion of Boolean operation on OR, AND, NAND

Competences	Content	Teaching and Learning Strategies
logic circuits. • describes logic circuits algebraically. • follows rules when evaluating a Boolean expression. • determines output levels from a diagram without using the Boolean expression. • uses Boolean theorems (rules) in the simplification of logic expressions and logic circuits.		and NOT. • Lead the learners through a guided discussion of describing logic circuits algebraically. • Illustrate the description of logic circuits algebraically. • Lead the learners through guided discussions of rules followed when evaluating a Boolean expression. • Illustrate the rules followed when evaluating a Boolean expression. • Lead the learners through guided discussions on use Boolean theorems (rules) that help to simplify logic expressions and logic circuits.

Assessment Strategy

Assign learners to:

i) derive a truth table of NOT, AND, NAND and OR.
ii) carry out practical exercises using basic digital module trainer to verify the truth table of simple logic circuit connection.
iii) do assignments on the use Boolean operation of the inputs to the OR, AND and NOT logic gates.
iv) participate in the discussion of describing logic circuits algebraically.
v) describe logic circuits containing inverters algebraically and submit for marking as assignment.

Teaching and Learning Resources

- Scientific calculator
- Internet
- Sample logic circuits

Sub-module 3: Combinational Logic Circuits

Duration: 15 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • identifies expressions of sum of product. • identifies expressions of product of sum. • applies sum of product and product of sum in the algebraic simplification of logic circuit. • uses the basic troubleshooting rules of digital systems. • deduces from observed results the faults of malfunctioning combinational logic circuits. • carries three basic steps in fixing a digital circuit or system that has faults (fault detection, fault isolation and fault correction). • identifies internal digital integrated circuit (IC) faults. • identifies external IC faults.	• Sum-of-product and product of sum • Algebraic simplification of logic circuit • Internal and external digital IC faults	• Lead the learners through guided discussions of the necessary steps to reduce a sum-of-product and product of sum expression to its simplest form in logic circuit design. • Illustrate the necessary steps to reduce a sum-of-product and product of sums expression to its simplest form in logic circuit design. • Lead the learners through guided discussions of algebraic simplification of logic circuit. • Illustrate the implementation of the simplification algebraic logic circuit. • Lead the learners through guided discussions of three basic steps in fixing a digital circuit or system that has faults (fault detection, fault isolation and fault correction). • Illustrate to learners how to use a logic probe in troubleshooting of digital ICs. • Illustrate the steps in fixing a digital circuit that has a fault by carrying out the following: - fault detection - fault isolation - fault correction. • Lead the learners through guided discussions of internal digital IC faults. • Illustrate the most common internal failures of digital ICs. • Lead the learners through guided discussions of external IC faults. • Illustrate the most common external IC faults.

Assessment Strategy

Let the learner:

i) do an assignment on identification of sum-of-product and product of sum expressions.
ii) work out assignments on the simplification of sum-of-product and product of sum and submit their work for marking.
iii) work out assignments on the simplification of algebraic logic circuit and submit in their work for marking the next day.
iv) practice to use a logic probe on digital logic circuits.
v) do assignments on the most common internal failures of digital ICs.
vi) practice to carry out fault detection, fault isolation and fault correction.
vii) hand in practical reports about fault detection, fault isolation and fault correction for marking.
viii) do an assignment on the most common external failures of digital ICs.

Teaching and Learning Resources

- Scientific calculator
- Wing boards

Sub-module 4: Flip-flops and Related Devices

Duration: 15 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • identifies the digital logic R-S flip-flop and verifies its logic output states. • identifies the clocked R-S flip-flop and verifies its logic output states. • identifies the digital logic T-	• R-S flip-flops • Type-T and Type-D flip-flops • J-K flip-flop • Frequency division and counting	• Lead the learners through guided discussions on digital logic R-S flip-flop. • Demonstrate R-S operation and verify its logic output states. • Lead the learners through guided discussions of clocked R-S flip-flop. • Demonstrate the clocked R-S flip-flop operation and verify its logic output states. • Lead the learners through guided discussions of Type-T

Competences	Content	Teaching and Learning Strategies
type flip-flop and verifies its logic output states. • identifies Type-T and Type-D flip-flops and verifies their logic output states. • identifies J-K flip-flop and verifies its logic output states.		and Type-D flip-flops. • Lead the learners through guided discussions of J-K flip-flop. • Illustrate other inputs like the preset and clear. • Lead the learners through guided discussions of frequency division and counting using J-K flip-flops wired in a three-bit binary counter.

Assessment Strategy

Let the learners:

i) discuss the digital logic R-S flip-flop.
ii) describe the digital logic R-S flip-flop.
iii) do class work to identify and draw Type-T and Type-D flip-flops and their output wave forms.
iv) describe J-K flip-flop.
v) draw J-K flip-flop and describe the preset and clear inputs.
vi) do class work to draw out the output wave forms of the J-K flip-flops wired in a three-bit binary counter.
vii) do assignments on frequency division and counting using J-K flip-flops wired in a three-bit binary counter.

Teaching and Learning Resources

- Writing boards
- Scientific calculator

Suggested References

Burris, S. (2009). The Algebra of Logic Tradition. Stanford Encyclopaedia of Philosophy.

Calixto, B. (2004). The Birth of Model Theory: Löwenheim's Theorem in the Frame of the Theory of Relatives. Princeton University Press. ISBN 978-0-691-05853-5.

Chan, Y. K. and Lim, S. Y. (2008). Progress in Electromagnetic Research B, Vol. 1, 269–290.

Digital Circuit Projects: An Overview of Digital Circuits through Implementing Integrated Circuits (2014):http://cupola.gettysburg.edu/cgi/viewcontent.cgi?article=1000&context=oer

Dov, M. G., John, W. Ed. (2004). The Rise of Modern Logic: from Leibniz to Frege. Handbook of the History of Logic. **3**. Elsevier. ISBN 978-0-444-51611-4.

Lala, P. K. (1996). Practical Digital Logic Design and Testing. Prentice Hall

Lessons in Electric Circuits - Volume IV (Digital):http://openbookproject.net/electricCircuits/Digital/index.html

Michael, P. and Myke, P. (2004). Digital Electronics Demystified. McGraw-Hill. ISBN 0-07-144141-7

MIT Open Programme Ware Introduction to Digital Design Class Materials ("6.004: Computation Structures"): http://ocw.mit.edu/programmes/electrical-engineering-and-computer-science/6-004-computation-structures-spring-2009/

Radomir S. S.; Jaakko, A. (2011). From Boolean Logic to Switching Circuits and Automata: Towards Modern Information Technology. Springer. ISBN 978-3-642-11681-0.

Vollmer, H. (1999). Introduction to Circuit Complexity. Berlin: Springer. ISBN 3-540-64310-9.

NCKS 223: Basic Kiswahili

Duration: 45 Hours

Module Overview

This module introduces the learner to the basic Kiswahili used in the industry and by the general public to carry out daily business. It also enables the learner to carry out his/her profession in any part of East Africa where Kiswahili is the major language of communication.

Learning Outcomes

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

i) make simple expressions in Kiswahili.
ii) count in Kiswahili
iii) construct coherent Kiswahili sentences.

Sub-module 1: Introduction to Kiswahili

Duration: 4 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • acknowledges the importance of learning and using Kiswahili language. • correctly greets elders, peers and the young at different times. • makes an introduction of oneself and other persons in Kiswahili.	• Origin and spread of Kiswahili • Importance of Kiswahili to Ugandans • Greetings: - at different times - to elders, peers, the young - to one person - to many people • General introduction - of oneself - of others	• Allow learners to buzz over different greeting styles. • Ask learners to make self-introductions before the class.

Assessment Strategy

Assess learners on the:

i) importance of learning Kiswahili in the context of computer maintenance and repair.
ii) greeting of peers, elders and supervisors at different times.

Sub-module 2: Definite Articles

Duration: 06 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • makes correct use of the Kiswahili alphabet. • pronounces Kiswahili verbs and names in the correct accent. • states phrases in the correct tense.	• Vowels and consonants • Verbs and nouns • Production of Kiswahili sounds/ accent	• Use tapes/compact disks for learners to listen to word sounds and pronunciations. • Guide learners on the names of different places and common titles in the computer maintenance and repair profession. • Set out a number of Kiswahili vowels, verbs and nouns for the learners to practice their application. • Use a tape recording to produce Kiswahili sounds for learners to emulate.

Assessment Strategy

Assess learners on:
i) word pronunciation.
ii) use of verbs and nouns.

Teaching and Learning Resources

- Kiswahili dictionary
- Documentaries
- Charts
- Video recordings
- Tape recorders
- Radio cassettes

Sub-module 3: Polite Language

Duration: 7 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • expresses appreciation to others. • makes requests for products, services, or places by names. • identifies people by their professional titles.	• Welcoming customers • Making requests • Presenting bills • Expressing appreciation • Advertising of products • Negotiating for better terms • Asking for pardon	• Organise a role-play in which learners shall make simple expressions involving asking for a particular product, service, place or direction and appreciating for the assistance offered. • Let learners express themselves by asking for forgiveness for a wrong done.

Assessment Strategy

Task learners to:

i) role-play the receiving of clients and providing information of the available goods/services.

ii) give assignment to design and format a Kiswahili advert for any business.

Teaching and Learning Resources

- The internet
- Kiswahili dictionary

Sub Module 4: Indefinite Articles

Duration: 6 hours

Competences	Content	Teaching and Learning Strategies
The learner: • combines words to construct good sentences.	• Introductory vocabulary • Sentence pattern	• Guide learners to use the indefinite articles to construct sentences. • Group learners to role play

Competences	Content	Teaching and Learning Strategies
• asks questions and responds to inquiries. • expresses likes and dislikes.	• Questions and responses • Expressing likes and dislikes	the asking and answering of questions related to catering services. • Ask learners to express their likes and dislikes in the role play.

Assessment Strategy

- Assess learners on the construction of sentences in response to questions.

Sub-module 5: Numbers and Arithmetic

Duration: 6 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • Counts and numbers items using the cardinal and ordinal numbers. • States the time, date, days and months correctly.	• Counting cardinal numbers • Counting ordinal numbers • Time, dates, days, months	• Lead learners in the counting exercise. • Guide learners in stating time and dates. • Ask learners to make presentations of their dates of birth.

Assessment Strategy

i) Let learners count using ordinal and cardinal numbers.
ii) Task learners to state different periods in Kiswahili.

Teaching and Learning Resources

- Charts of numbers, dates and days
- Calendar
- Clock
- Mathematical symbols

Sub-module 6: Grammar and Syntax

Duration: 08 hours

Competences	Content	Teaching and Learning Strategies
The learner: • makes a logical flow of sentence construction. • applies the singular and plural nouns/verbs correctly. • applies correct Kiswahili tenses in sentence construction.	• Basic sentence elements • Sentence logic • Singular and plural • Tenses	• Guide learners to make sentences in Kiswahili using first person singular and first person plural. • Let learners demonstrate the application of different tenses in sentence construction.

Assessment Strategy

Assess learners on:

i) the way they arrange the words in a sentence.
ii) the rule of singular and plural.
iii) the application of tenses.

Sub-module 7: Professional-related Vocabulary

Duration: 8 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • identifies and names the tools, materials, and equipment used in computer maintenance and repair. • refers to officers in computer maintenance and repair by their titles. • describes the tasks performed by different computer technicians.	• Names of tools, materials, and equipment used in computer maintenance and repair management • Titles of officers in computer maintenance and repair • Tasks performed by computer technicians	• Guide learners to identify and name the tools, materials, and equipment used in computer maintenance and repair. • Ask learners to find out the Kiswahili titles of people who work in computer maintenance and repair. • Discuss with learners the tasks performed by different computer technicians.

Assessment Strategy

- Assign learners to write the titles and tasks performed by various computer technicians.

Teaching and Learning Resources

- The Internet
- Kiswahili dictionary

Suggested References

Almasi, W.F. (2014). Swahili Grammar for Introductory and Intermediate Levels

Fidèle, M. (2015). Swahili Grammar and Workbook. New York. Routledge Publishers

Maw, J.E. (2012). Swahili for Starters: A Practical Introductory and Intermediate Level.

Michele, D. (2017). Oxford Essential Dictionary for Kiswahili Learners of English. Kindle Edn. Oxford University Press.

Mohamed, A. M. (2001). Modern Swahili Grammar. East African Education Publishers, Kenya

Shule Direct Tanzania, World Reader (2016). Kiswahili kwa Shule za Sekondari. Kindle Edn.

NCCM 224: PC Maintenance and Repair

Duration: 75 Hours

Module Overview

This module introduces the learner to the practical knowledge of maintaining, troubleshooting, repairing and assembling computers.

Learning Outcomes

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

i) maintain the computer system.
ii) troubleshoot computer-related errors and problems.
iii) carryout computer repair.

Sub-module 1: Introduction to the Personal Computer System

Duration: 6 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • describes the construction of personal computer systems. • explains how personal computer systems work together. • selects appropriate computer components necessary for building a	• Personal computer systems: - cases and power supplies, internal PC components, external ports and cables, input and output devices • Select computer components: - building a computer: select the motherboard, the case and fans, the power supply, the CPU and CPU cooling system, RAM, adapter cards, hard drives, a media reader, optical drives, external storage, input and output devices) • Configurations for	• Together with learners, brainstorm the construction of personal computer systems. • Guide learners to explain how personal computer systems work together. • Lead learners' practice to select appropriate computer components. • Guide learners in

Competences	Content	Teaching and Learning Strategies
computer. • explains how hardware is configured for task-specific computers. • carries out hardware configuration for task-specific computers.	specialised computer systems: - specialized computer systems (thick and thin clients, CAX workstations, audio and video editing workstations, virtualization workstations, gaming PCs, home theatre PCs)	groups to explain how hardware is configured for task-specific computers.

Assessment Strategy

- Assign learners to carry out maintenance of different devices of a computer system.

Teaching and Learning Resources

- A computer system and peripherals including the necessary devices
- Maintenance toolkit
- Personal computer systems

Sub-module 2: Introduction to Laboratory Procedures and Tool Use

Duration: 8 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • practices safe lab procedures. • practices proper use of	• Safe lab procedures: - procedures to protect people (general safety, electrical safety, fire safety) - procedures to protect equipment and data (ESD	• Explain the purpose of safe working conditions and safe lab procedures.

Competences	Content	Teaching and Learning Strategies
maintenance tools.	and EMI, power fluctuation types, power protection devices) - procedures to protect the environment (safety data sheet, equipment disposal) • Proper use of tools: - hardware tools (ESD) tools, hand tools, cable tools, cleaning tools, diagnostic tools - software tools (disk management tools, protection software tools - organisational tools (personal reference tools, miscellaneous tools) - demonstrate proper tool use of: antistatic wrist strap, antistatic mat, hand tools, using a multi-meter and a power supply tester, cleaning materials	• Guide learners to practice safe lab procedures • Explain how to use tools and software with personal computer components and task learners to practice.

Assessment Strategy

- Assign learners to assemble some faulty computers and give them homework to carry out computer troubleshooting. Let them identify the POST errors and problems in the given computers.

Teaching and Learning Resources

- A computer system
- Repair toolkit
- Working computers
- Faulty computers

Sub-module 3: Computer Assembly

Time: 12 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • assembles the computer using the correct chronology. • practices booting of the computer. • upgrades and configures a computer.	• Assembling the computer: - opening the case and connect the power supply - installing the CPU and the heat sink and fan assembly on the motherboard before inserting it in the case - installing RAM - installing the motherboard in the case - Installing the drives - Installing the adapter cards - Installing the cables • Booting the computer: - POST, BIOS, UEFI (BIOS Beep Codes and Setup, BIOS and CMOS, BIOS Setup Program, UEFI Setup Program) - BIOS and UEFI configuration (BIOS component information, BIOS configurations, BIOS security configuration, BIOS hardware diagnostics and monitoring, UEFI EZ mode, UEFI advanced mode) • Upgrading and configuring a computer: - Motherboard and Related Components (motherboard component upgrades, upgrade the motherboard, upgrade the BIOS, upgrade CPU and heat sink and fan assembly, upgrade RAM) - Storage devices (upgrade storage devices) - Upgrade storage devices (upgrade input and output devices)	• Guide learners through practise to build a computer system by assembling the different components. • Task learners in groups to explain how to verify BIOS and UEFI settings. Guide them to practice booting of the computer. • Guide learners on how to upgrade components in a computer system to meet requirements and task them to practice.

Assessment Strategy

- Assign learners to install operating systems on a computer and a lab activity to install software and hardware.

Teaching and Learning Resources

- Toolkit,
- Operating system
- CDs/DVDs, Computers, CD/DVD drivers
- Hard disk drives

Sub-module 4: PC Preventive Maintenance

Duration: 8 Hours

Competences	Content	Teaching and Learning Strategies
The learners: • describes the benefits and tasks of preventive maintenance. • carries out the preventive maintenance tasks on personal computers. • explains the computer troubleshooting process. • executes troubleshooting tasks.	• PC preventive maintenance overview: - benefits of preventive maintenance - preventive maintenance tasks: hardware tasks and software tasks - cleaning the case and internal components - inspecting internal components - environmental concerns - guidelines to help ensure optimal computer operating performance • Troubleshooting process: - Troubleshooting Process steps - Common PC problems and solutions	• Lead a guided discussion on benefits of preventive maintenance on personal computers. • Demonstrate how to troubleshoot computer problems and task them to practice.

Assessment Strategy

- Assign learners to assemble a computer and practice to install and configure a motherboard.

Teaching and Learning Resources

- Repair toolkit
- Motherboards
- System casings
- Power supply

Sub-module 5: Windows Installation

Duration: 10 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • describes the operating system requirements . • installs Microsoft Windows operating system.	• Modern operating system: - operating system terms and characteristics - types of operating systems (desktop and network operating systems - customer requirements for an operating system (OS compatible applications and environments, minimum hardware requirements and compatibility with the OS platform) - operating systems upgrade (checking OS compatibility, windows OS upgrades, data migration) • Operating system installation: - storage device setup procedures (storage device types, hard drive partitioning, file systems, OS installation with default settings, account creation, finalize the installation, OS installation with default settings, account creation, finalize the	• Lead a guided discussion on operating system terms and characteristics. • Demonstrate to Learners how to install a Microsoft windows operating system and they practice.

Competences	Content	Teaching and Learning Strategies
	installation) - custom installation options (disk cloning, other installation methods, network installation, restore, refresh, and recover, system recovery options) - boot sequence and registry files (windows boot process, start-up modes, windows registry) - multi-boot (multi-boot procedures, disk management utility, partitions, drive mapping or drive letter assignment) - disk directories (directory structures, user and system file locations, attributes, and application, file, and folder properties)	

Assessment Strategy

i) Task learners to configure an external storage media/device in a lab activity.
ii) Learners format a hard disk drive and explain how each step is performed.
iii) Task learners to write data in CDs/DVDs. They should explain the procedure followed.
iv) Task learners to carry out data backup to an external media.

Teaching and Learning Resources

- Hard disks, flash disc, and memory cards
- CDs/DVDs, CD/DVD writer, burning software such as Nero, etc.
- Backup drives
- Overhead projector

Sub-module 6: Windows Configuration and Management

Duration: 6 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • Performs routine system management tasks with common Microsoft Windows tools. • describes the features of client-side virtualization. • configures virtualization on a computer. • uses common preventive maintenance techniques for Microsoft Windows operating systems. • carries out basic troubleshooting for Microsoft Windows operating systems.	• The windows GUI and control panel: - windows desktop, tools and applications - control panel utilities - administrative tools - disk defragmenter and disk error-checking tool - command line tools • Client-side virtualization - purpose of virtual machines - hypervisor: virtual machine manager - virtual machine requirements • Common preventive maintenance techniques for operating systems: - preventive maintenance plan contents - updates - scheduling tasks - restore points - hard drive backup • Basic troubleshooting process for operating systems: - applying the troubleshooting process for operating systems - common problems and solutions	• Guide learners to perform routine system management tasks with common Microsoft Windows tools. • Lead learner's practice to configure virtualization on a computer. • Guide learners on how to use common preventive maintenance techniques for Microsoft Windows operating systems. • Task learners in groups to troubleshoot Microsoft Windows operating systems.

Assessment Strategy

i) Task learners to configure an external storage media/device in a lab activity.
ii) Learners format a hard disk drive and explain how each step is performed.
iii) Task learners to write data in CDs/DVDs. They should explain the procedure followed.
iv) Task learners to carry out data backup to an external media.

Teaching and Learning Resources

- Hard disks, flash disc, and memory cards.
- CDs/DVDs, CD/DVD writer, burning software such as Nero etc.
- Backup drives
- Overhead projector

Sub-module 7: Laptops and Mobile Devices

Duration: 10 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • explains the purpose and characteristics of laptops. • configures laptop power settings and wireless settings. • demonstrates how to remove and install laptop components. • explains the purpose and characteristics of mobile	• Laptop components - features of laptop components (external features unique to laptops, common input devices and LEDs in laptops, internal components, special function keys, docking station vs. port replicator) - laptop displays (LCD, LED, and OLED displays, backlights and inverters, WI-FI antenna connectors, webcam and microphone) • Laptop configuration: - power settings configuration - wireless configuration • Laptop hardware and component installation and configuration:	• Brainstorm the purpose and characteristics of laptops. • Guide learners to configure laptops' power settings and wireless settings. • Lead learners to practice to remove and install laptop components. • Task learners in groups to explain the purpose and characteristics of mobile devices.

Competences	Content	Teaching and Learning Strategies
devices. • Performs common preventive maintenance techniques for laptops and mobile devices. • Troubleshoots laptops and mobile devices.	- expansion slots - replacing hardware devices • Mobile device hardware overview: - mobile device hardware - other mobile devices • Common preventive maintenance techniques for laptops and mobile devices: - scheduled maintenance for laptops and mobile devices • Basic troubleshooting process for laptops and mobile devices	• Guide learners to perform common preventive maintenance techniques for laptops and mobile devices. • Guide learners in groups to troubleshoot laptops and mobile devices.

Assessment Strategy

i) Task learners to configure an external storage media/device in a lab activity.
ii) Let learners format a hard disk drive and explain how each step is performed.
iii) Task learners to write data in CDs/DVDs. They should explain the procedure followed.
iv) Task learners to carry out data backup to an external media.

Teaching and Learning Resources

- Hard Disks, flash disc, and memory cards.
- CDs/DVDs, CD/DVD writer, burning software such as Nero etc.
- Backup drives
- Overhead projector

Sub-module 8: Printers

Duration: 9 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • explains the purpose and characteristics of different types of printers. • installs a printer. • configures printer sharing. • explains how to improve printer availability.	• Common printer features: - characteristics and capabilities - printer types • Installing and configuring printers: - installing and updating a printer - configuring options and default settings - optimizing printer performance • Sharing printers: - operating system settings for sharing printers - print servers • Maintaining and troubleshooting printers: - printer preventive maintenance - troubleshooting printer issues - common problems and solutions for printers	• Lead a guided discussion on the purpose and characteristics of different types of printers. • Demonstrate to Leaners how to Install and Configure a printer and they practice. • Task Learners to brainstorm on common troubleshooting issues and solutions for printers

Assessment Strategy

i) Task learners to configure an external storage media/device in a lab activity.
ii) Let learners format a hard disk drive and explain how each step is performed.
iii) Task learners to write data in CDs/DVDs. They should explain the procedure followed.
iv) Task learners to carry out data backup to an external media.

Teaching and Learning Resources

- Hard disks, flash disc, and memory cards.
- CDs/DVDs, CD/DVD writer, burning software such as Nero, etc.
- Backup drives
- Overhead projector

Sub-module 9: Computer Security

Duration: 6 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • troubleshoots basic security problems. • manages IT security on an ongoing basis. • configures IT security. • explains PC security threats	• Security threats: - types of security threats • Security procedures: - windows local security policy - securing web access - protecting data - protection against malicious software - security techniques - protecting physical equipment • Common preventive maintenance techniques for security - security maintenance • Basic troubleshooting process for security	• Lead a guided discussion on types of security threats. • Group learners and task them to discuss on how to manage IT security on an ongoing basis. • Demonstrate to learners how to configure IT security. • Task learners in groups to discuss on PC security threats

Assessment Strategy

i) Assign learners to configure an external storage media/device in a lab activity.

ii) Task learners to discuss the basic troubleshooting process for security.

Teaching and Learning Resources

- Hard disks, flash disc, and memory cards.
- CDs/DVDs, CD/DVD writer, burning software such as, Nero etc.
- Backup drives
- Overhead projector

Suggested References

Basic Computer Maintenance. https://www.computer-pdf.com/architecture/710-tutorial-basic-computer-maintenance.html

Computer Architecture. https://www.computer-pdf.com/architecture/75-tutorial-programme -computer-architecture.html

Computer Basics. https://www.computer-pdf.com/other/5-tutorial-programme -computer-basics-tutorial.html

Glenn, B. G. (1991). Computer Systems Concepts and Design. Prentice Hall

Jean, A. (2016), CompTIA A+ Guide to IT Technical Support + Lab Manual. 9th edition. Programme Technology Ptr.

Mike, M. (2007), Guide to Managing and Troubleshooting PCs. Second Edition. McGraw-Hill, Inc. New York.

Mike, M. (2016), Managing and Troubleshooting PCs, Fifth Edition. McGraw-Hill Education

Morris, M. (1993). Computer Systems Architecture. Prentice Hall

Tanebaum, A. S. (1984). Structured Computer Organization. Prentice Hall

William, S. (2003). Computer Organization and Architecture. Prentice Hall

NCCM 224: Real Life Project 4

Duration: 60 Hours

Module Overview

This module will develop the learner's skills of repairing and maintaining computers and other devices (desktops, laptops and printers).

Learning Outcome

By the end of this module, the learner should handle network, software and hardware computer diagnosis, repair and maintain computers.

Competences	Content	Teaching and Learning Strategies
The learner: • assembles computers. • disassembles computers. • configures computers on a network. • troubleshoots, repairs and maintains computers. • prepares repair job cards and logs. • prepares workshop reports.	• Assembling of computers • Disassembling computers • Configuring computers on a network • Troubleshooting, repairing and maintaining computers • Preparing repair job cards and logs • Preparing workshop reports	• Guide learners to select the most appropriate projects. • Supervise learners through their projects execution and give technical support where necessary.
Sample Projects • Hardware configurations • Software configurations • Network configuration troubleshooting • Workshop documentation		

Teaching and Learning Resources

- Computers
- Logic circuits
- Sample project reports
- Electronics systems
- Windows OS
- Sample workshop reports
- Repair job cards
- Maintenance toolkit

Suggested References

Elena, A. (2016). *The Application of Projects Methods in Training Students in Secondary Vocational Education.* Olympiáda techniky Plzeň. https://otik.uk.zcu.cz/bitstream/11025/21421/1/Artemieva.pdf

Project Computer Sales and Service Centre (2): https://www.scribd.com/doc/94974615/Project-Computer-Sales-and-Service-Centre-2

Project Report of Computer Shop Management: https://www.scribd.com/doc/266737244/Project-Report-on-Computer-Shop-Management-System

NCCM 225: Industrial Training 2

Duration: 240 Hours (8 weeks)

Competences	Content	Teaching and Learning strategies
The learner: • puts in practice the skills and knowledge acquired in class. • demonstrates ability to manage computer hardware and software. • maintains and repairs different electronics equipment and gadgets.	**Suggested areas of training** • Using MS office applications to input and printout information • Creating circuits • Installing windows OS • Troubleshooting Windows installation • Updating, patching and configuring security settings • Backing up systems • Setting restore points • Applying safety measures when handling ICT equipment • Demonstrating effective communication skills • Maintenance and repair of PCs and other electronic systems and gadgets • Managing PC hardware and software including security of PC systems	• Lead a guided discussion on the Industrial Training Guidelines. • Guide learners on how to use logbooks (daily activity record books). • Guide learners on how to write Industrial Training reports. • Guide a discussion on the required professional behaviour and communication skills during Industrial Training.

Assessment Strategy

i) Field supervisors scores the candidate according to the attached Industrial Training Guidelines.

ii) Academic supervisor visits the field to observe the trainee performance, and interview the field supervisor about the trainee's performance.

Teaching and Learning Resources

- Telephone contact/address of the trainees
- Industrial Training placements
- Industrial training Assessment Forms
- Trainees' logbooks/ record books
- Sample Industrial Training reports
- Computers
- ICT workshops and gadgets/equipment
- Electric and electronic circuits
- Maintenance toolkits

Appendices

Appendix 1: Industrial Training Guidelines

The guidelines below should be followed during Industrial Training:

1. It starts at the end of the academic year.
2. It takes a minimum period of 6 weeks.
3. It is carried out at the world of work located in any part of Uganda including the training institutions.
4. The training institution has the duty of:
   - budgeting for Industrial Training.
   - obtaining money from government for government-sponsored learners.
   - explaining to the learners what they are expected to do.
   - finding placements for Industrial Training.
   - posting learners to Industrial Training.
   - supervising and assessing learners during Industrial Training.

Supervision

i) There should be a world of work or field or industry supervisor and an academic supervisor from the training institution.
ii) The academic supervisor visits the attachment site or industry at least once, and interacts with both the learner and field supervisor.

Assessment

Assessment marks should be categorised as follows:

- Assessment by field supervisor 50%
- Assessment by academic supervisor 30%
- Field attachment report 20%

All the above assessment categories must be carried out for one to complete Industrial Training. The marks awarded by each category must be verified by UBTEB.

Appendix 2: Industrial Training Assessment Form for Field or Onsite Supervisor

Name of Institution..... Name of Industry.....

Name of learner ..... Signature.....

Registration Number..... Name of supervisor.....

Signature ..... Date.....

	Area of Assessment	Marks	Score	Area of Improvement
1	**Attendance (% age of days and times within the days present)**	**5**		
2	**Work Performance Involvement**	**30**		
	Co-operation with other staff	5		
	General ability to use various equipment, machines or plant in the industry	10		
	Flexibility-willingness to learn from various sections in industry	7		
	Job planning	8		
3	**Initiative and Innovations**	**15**		
	Problem-solving	8		
	New ideas on improvement for efficiency of performance or operations	7		
4	**Time Management**	**5**		

	Reporting on time	1		
	Leaving at specified break-off or stoppage time	1		
	Meeting deadlines on assignments given by supervisors or instructors	3		
5	**Discipline and Safety Observation**	**15**		
	Use of right equipment for right job	4		
	Obeying instructions	4		
	Proper handling of equipment and or materials	2		
	Ability to practice safety measures in the workplace	3		
	Knowledge of first aid procedures in case of accident	2		
6	**Practical Skills**	**20**		
	Ability to put into practice training instructions from instructors or supervisors	4		
	Ability to relate theoretical knowledge with practical applications	4		
	Proper use of manuals and interpretation of drawings	4		
	Ability to carry out troubleshooting on equipment, (put right mistake in work or	4		

	finishing)			
	Ability to service and repair equipment (clean and maintain tools and workplace)	4		
G	**General Remarks (other assessment at discretion of assessor)**	**5**		

The assessment shall be carried out as indicated in each area and then the total mark obtained is computed to 50%.

Appendix 3: Industrial Training Assessment Form for Academic Supervisor

Name of Institution..... Name of Industry.....

Name of learner ..... Signature.....

Registration Number..... Name of supervisor.....

Signature ..... Date.....

	Area of Assessment	Marks	Score	Area of Improvement
1	**Attendance (Was the learner at his work place?)**	**5**		
2	**Understanding of tasks**	**21**		
	Did the learner provide weekly summary of work performed?	2		
	How did the learner describe the tasks performed?	4		
	How was the learner able to explain why tasks were being done in a particular way?	3		
	How did the learner explain problems experienced when carrying out the work and how they were solved?	3		
	How did the learner explain the knowledge and skills acquired at	2		

	the institute that enabled him to perform?			
	How did the learner describe the new knowledge and skills gained?	3		
	How did the learner explain his relationship with his co-workers and supervisors and how he plans to improve or maintain it?	2		
	How did the learner relate the Industrial Training tasks to his training as a technician?	2		
3	**General Remarks (Other assessment at discretion of examiner)**	**4**		
Total mark		**30**		

The assessment shall be carried out as indicated in each area and then the total mark obtained is computed to 30%.

Appendix 4: Field Attachment Report and Guide for Industrial Training

The report should be written in English and contain the following to be assessed as shown:

No	Contents	Maximum Score
1	**Cover page:** i) Name of Institution ii) Name of Department iii) Name of learner and year of study iv) Place of Industrial Training v) Period of Industrial Training e.g. July- September 1510 vi) Academic and Field Supervisor's signatures	1 mark
2	**Acknowledgements** i) Acknowledge all assistance during field training ii) Acknowledge assistance during report writing	0.5 marks
3	**Executive summary or abstract** i) To include statement of the most practical work carried out ii) Challenges iii) Conclusions	2 marks
4	**Table of contents** To show the content of the report and page numbers where they first occur	0.5 marks
5	**List of figures** i) All figures in the report must have a number and a caption. ii) Figures must be numbered according to the chapters where they occur for example; Figure 4.1, to refer to first Figure in chapter 4. iii) The pages where the figures occur must be shown in the list of figures.	0.5 marks
6	**List of tables** i) All tables in the report must have a number and a header ii) Tables must be numbered according to the chapters where they occur for example; Table 2.1, to refer to first table in Chapter 2	0.5 marks

	iii) The pages where the tables occur must be shown in the list of tables	
7	**List of acronyms or abbreviations** Acronyms used should be given in alphabetical order with their full meaning shown	0.5 marks
8	**Introduction** i) Location and description of place of field attachment ii) Objectives of field attachment iii) Structure, organisation iv) Tasks carried out by the place attached to e.g. if District Local Government describe its role in society	2 Marks
9	**Main body of the report** i) Description of work carried out ii) Duties and responsibilities assigned and how they were carried out iii) New knowledge and skills gained iv) Relationship with other staff and supervisor v) Problems experienced and how they were handled	8 marks
10	**Conclusions** A brief summary of knowledge gained as outlined in the objectives	1mark
11	**Recommendations** i) For improving Industrial Training, usually derived from problems experienced ii) For improvement of work output at the place of work (this is included if allowed by the field supervisor)	1.5 marks
12	**References** i) Design standards and guidelines used during training ii) Books and internet material iii) Harvard style of referencing must be used for example Kyalikisa R (1510), "Effect of window net on the reduction of Malaria," Journal Health Construction, Vol 17, Pg 123-127	1 mark
13	Appendices i) Drawings ii) Photographs, etc	1 mark
Total mark		20 marks

Appendix 5: Tools and Equipment for the Programme

S/N	Equipment
1	Circuit brakers and accessories
2	Circuit protectors
3	Fuse holders
4	Fuse
5	Surge suppressors
6	Thermistor
7	Thyristors
8	Varistors
9	Audio & video connectors
10	Board to board & mezzanine connectors
11	Card edge connectors
12	Fibre optic connectors
13	I/O connectors
14	Junction systems
15	Memory connectors
16	RF interconnectors
17	USB connectors
18	Audio devices
19	Encoders
20	Hardware components
21	Computers-assorted
22	Printers
23	Relays
24	Switches-assorted
25	Analogue digital development tools
26	Communication development tools
27	Development software
28	Display development tools
29	Processor development kit
30	Fibre optic development tools
31	PLC development tools
32	Sensor development tools
33	Memory ICs
34	Memory modules

35	Integrated circuits-assorted
36	Wireless & RF semiconductors-assorted
37	Analysers
38	Audio/video test equipment
39	Fibre optic testing equipment-
40	LAN/telecom/cable tester
41	Oscilloscopes
42	Digital measuring equipment-assorted
43	Acoustic devices-assorted
44	Cable assemblies
45	Coaxial cables
46	FFC/FPC jumper cables
47	Fibre optic cable
48	Flat cables
49	Hook-up wire
50	Multi-conductor and paired cable
51	Logit circuits
52	Circuit boards
53	Multi-meters/voltmeters
54	Electronic repair tool kit
55	Power plugings and cabling
56	Audio/video data
57	Television sets-assorted
58	Radio receivers

NCDC
NATIONAL CURRICULUM DEVELOPMENT CENTRE

National Curriculum
Development Centre ,
P.O. Box 7002,
Kampala.
www.ncdc.go.ug