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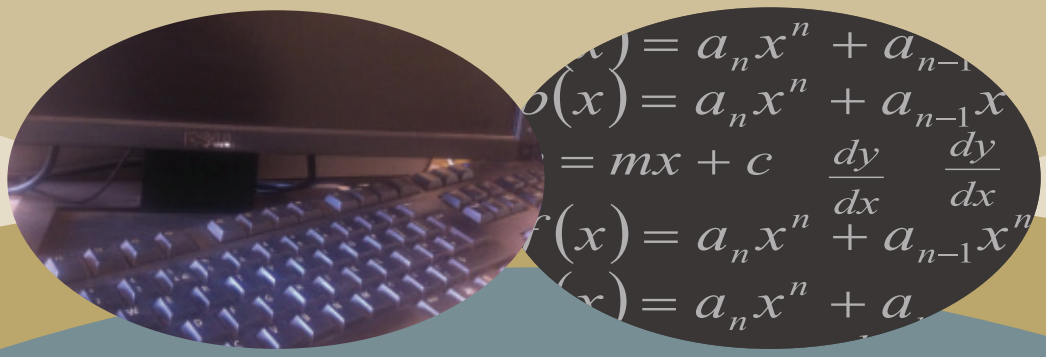

Uganda Advanced Certificate of Education

TEACHING SYLLABI FOR
Subsidiary Mathematics
Subsidiary Information and Communication Technology

VOLUME 10
2013

THE REPUBLIC OF UGANDA
Ministry of Education and Sports

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Last but not least, NCDC would like to thank all those who worked behind the scenes to finalise the documents.

NCDC takes full responsibility for any errors and omissions in the documents and welcomes suggestions to address them.

Connie Kateeba
DIRECTOR,
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FOREWORD

This is the first time Uganda is having the subject of ICT taught at the Advanced level secondary education. This subject is oriented towards acquisition of practical competences for the world of work. As a subsidiary subject, it gives it a wider coverage across the spectrum of subject combinations. The skills covered in this syllabus are important and relevant across subject combinations.

The syllabi of Subsidiary Mathematics and Subsidiary ICT have topics that are largely intended to address the skills in the Mathematics and ICT that every learner needs in the 21st Century. It is incumbent upon the teachers to make the teaching of the topics in these teaching syllabi as practical as possible and relevant to the world of work.

Each topic has a background and guidance to the teacher to relate it to its practical application and demystify the areas of emphasis for uniform coverage. This, coupled with the learning outcome, gives the teacher guidance on how to structure the teaching to make it relevant to the learner.

The teaching / learning strategies suggested in the syllabi are just a guide but are not meant to substitute the rich professional approaches that the teacher may opt to use to deliver knowledge, and to develop understandings, skills, values and attitudes.

Uganda Advanced Certificate of Education

Subsidiary Mathematics

TEACHING SYLLABUS

CONTENTS

Introduction

Subsidiary Mathematics has been part of the Advanced Level curriculum for a long time but the Teaching Syllabus has not been in place. The National Mathematics Panel for Subsidiary Mathematics has designed a Teaching Syllabus to ease the teaching and learning of the subject. The content of Subsidiary Mathematics has been reviewed. Some content in the previous syllabus has been removed while new content has been brought on board to address learning needs of the 21st Century student. The review has focused on:

i) the mathematics that is applicable in the world of work

ii) reducing content to make it suitable to all categories of learners

iii) equipping learners with mathematical skills that are desirable for further learning and in the world of work.

The current societal needs in Uganda have been a major factor during the identification of content to be added or removed from this subject. Only the relevant content has been retained.

The area of application of knowledge acquired in each topic is provided in the background.

Purpose of the Teaching Syllabus

The Subsidiary Mathematics Teaching Syllabus is meant to guide teachers handling the subject at Advanced Level. It is designed to achieve the aims of teaching Subsidiary Mathematics, standardise teaching of the subject across the country and guide the teacher during the teaching and learning process. It is also meant to guide on how the mathematical skills and competences in this subject can be developed among the learners across the subject topics.

Broad Aims of Education in Uganda

This syllabus contributes towards achieving the broad aims of education listed in the Government White Paper on Education of 1992 as follows:

1. To promote understanding and appreciation of the value of national unity, patriotism and cultural heritage, with due consideration of internal relations and beneficial inter-dependence.

2. To inculcate moral, ethical and spiritual values in the individual and to develop self-discipline, integrity, tolerance and human fellowship.
3. To inculcate a sense of service, duty and leadership for participation in civic, social and national affairs through group activities in educational institutions and the community.
4. To promote scientific, technical and cultural knowledge, skills and attitudes needed to promote development.
5. To eradicate illiteracy and to equip the individual with basic skills and knowledge to exploit the environment for self-development as well as national development, for better health, nutrition and family life and the capacity for continued learning.
6. To contribute to the building of an integrated, self-sustaining and independent national economy.

Aims and Objectives of Secondary Education in Uganda

The Government White Paper on Education provides the following aims and objectives of secondary education in Uganda;

1. Instilling and promoting national unity and an understanding of social and civic responsibilities; strong love and care for others and respect for public property as well as an appreciation of international relations and beneficial international co-operation.
2. Promoting an appreciation and understanding of the cultural heritage of Uganda including languages.
3. Imparting and promoting a sense of self-discipline, ethical and spiritual values, personal responsibility and initiative.
4. Enabling individuals to acquire and develop knowledge and an understanding of emerging needs of society and the economy.
5. Providing up-to-date and comprehensive knowledge in theoretical and practical aspects of innovative production, modern management methods in the field of commerce and industry and their application in the context of social-economic development of Uganda.
6. Enabling individuals to develop basic scientific, technological, agricultural, and commercial skills required for self-development.

7. Enabling individuals to develop personal skills of problem-solving, information-gathering and interpretation, independent reading and writing, self-improvement through learning and development of social, physical and leadership skills such as are obtained through games, sports, societies and clubs.
8. Laying the foundation for further education.
9. Enabling the individual to apply acquired skills in solving problems of the community.
10. Instilling positive attitudes towards productive work and strong respect for the dignity of labour and those who engage in productive labour activities.

Aims of Teaching Subsidiary Mathematics

Teaching Subsidiary Mathematics is aimed at:

a) enabling learners acquire a range of mathematical skills that are applicable in everyday situations and other subjects they may be studying.

b) equipping learners to use mathematics as a means of communication with emphasis on clear expression.

c) inspiring learners to develop an attitude of logical thought.

d) building on the basic mathematical concepts for better understanding of the subject by every learner at A level.

e) empowering learners to construct mathematical models by:

   i) developing mathematics to the limits of their ability.

   ii) applying mathematics with confidence to unfamiliar real situations.

   iii) specialising in mathematical techniques required for further education or vocation.

   iv) having a positive attitude towards mathematical problem-solving.

   v) appreciating as far as possible the satisfaction and enjoyment that may be gained from pursuing the subject for its own sake.

vi) presenting and interpreting mathematical information in diagrammatic, tabular and graphic form.

Target

This Teaching Syllabus is intended for the Subsidiary Mathematics A Level secondary school teacher. It can also be used by the learner for guidance of personal learning and practice of mathematical concepts identified in this syllabus.

Scope and Depth

The Teaching Syllabus covers Pure Mathematics, Mechanics, Probability and Statistics.

Teaching Sequence

The topics have been arranged in chronological order of skills acquisition. You are advised to follow the teaching sequence for effective teaching and learning of the subject.

Time Allocation

Subsidiary Mathematics should be allocated 6 **periods**, each of **40** or **45 minutes** a week on the timetable. This is to allow enough time for learners to engage in a variety of learning activities and develop problem-solving skills. You are advised to expose learners to real world circumstances so that they are motivated to apply mathematical knowledge and reasoning in real life as much as possible. `Learning by doing' should be practised.

How to Use the Syllabus

This syllabus focuses on developing mathematical skills for day-to-day application and further learning. Teaching and learning of this subject should focus more on skill acquisition development and application if the learner is to benefit from it.

The suggested teaching-learning approaches in this syllabus are not an end in themselves. The teachers are encouraged to devise other teaching strategies to enable the learners develop competences described in this syllabus.

Syllabus Features

The teaching syllabus for Subsidiary Mathematics has the following features:

Duration

This gives the proposed number of periods for each topic, each period being of 40 or 45 minutes duration. This is to guide the teacher cover the syllabus adequately.

Learning Outcome

This is the statement that specifies what the learner will be able to do upon successful completion of the topic.

Competences

These define a specific range of skills, knowledge, or ability to be acquired by the learners. The teacher should use the competences to plan the teaching-learning strategies suitable for the lesson. Competences also guide in evaluating whether learning actually took place.

Learning/Teaching Strategies

These provide the teacher with guidance on the proposed activities and (methods/methodology) that can be used in the teaching. The following are the suggested learning/teaching strategies;

i) **Teacher guided research:** An instructional technique where the teacher gives students areas to read individually or in groups and later have a class discussion.

ii) **Peer presentation:** An instructional technique where the students share the knowledge they have in class with the teacher's guidance.

iii) **Brainstorming:** A technique used to gather ideas spontaneously contributed by learners. It is an effective way to generate ideas on a specific issue and then determine which idea(s) is the best.

iv) **Teacher exposition:** An instructional technique where you put the topic into context for the learner to elicit his/her contributions.

v) **Simulations:** A representation of the behaviour or characteristics of one system through the use of another system especially a computer program designed for the purpose.

Note: The teacher is not restricted to the suggested learning/teaching strategies.

Guidance to the Teacher

This is to guide the teacher prepare for lessons on a given topic. It spells out the areas of emphasis and tools to be used in a given topic.

Mode of Assessment

Continuous Assessment

This shall be carried out by the subject teacher within the provided teaching time to determine the student's progress. It can be done in a variety of forms such as written, oral or practical, real life or abstract; completed individually or as a group. A variety of approaches should be used so that a learner can draw inferences about learning based on information obtained through broad approaches like observing, questioning and testing.

The assessment should equally focus on all the sections. Continuous Assessment should help the learner to:

i) Apply relevant mathematical concepts, terminologies and notations;

ii) Recall accurately and successfully use appropriate manipulative techniques;

iii) Recognise the appropriate mathematical procedure for a given situation;

iv) Apply combinations of mathematical skills and techniques in solving problems.

v) Present mathematical work, and communicate conclusions, in a clear and logical way.

Summative Assessment

This shall be done at the end of the two years of Advanced Level education by Uganda National Examinations Board. The examination will be formatted as follows:

There will be one paper of **2 hours 40 minutes**. The paper will consist of **two** sections: Section A and Section B.

Section A will comprise short questions on Pure Mathematics, Statistics and Mechanics while Section B will comprise longer questions. Section A will consist of **eight (**8) compulsory questions. Candidates will be required to attempt all questions each carrying 5 marks. Section B will consist of **six** (6) questions of which candidates will be required to attempt any **four** (4) each carrying 15 marks.

In Section B, **Six** (6) questions will be set from Pure Mathematics, Mechanics and Probability and Statistics.

Assessment Strategy

Exercises in Class

These should be done in the teacher's presence and marked.

Assignments

Learners should be given homework to enable mastery of the content, should be marked and corrections made. Remedies should be given where necessary.

Short Test

This should be at the end of the sub-topic or topic, as the case may be.

Outline of the Teaching Syllabus

SENIOR FIVE	**TERM ONE**	
SECTION A	**SECTION B**	
1. The Scientific Tool Calculator 2. Indices - Logarithms - Surds	4. Descriptive Statistics - Introduction to Statistics - Organisation of	5. Motion in a Straight Line

3. Polynomials	Data - Measures of Central Tendency - Measures of Dispersion	
SENIOR FIVE	**TERM TWO**	
6. Quadratics 7. Differentiation - Derivative of a Function - Tangents and Normals - Second Derivative -	8. Moving Averages 9. Index Numbers 10. Correlation	11. Resultant and Components of Forces
SENIOR FIVE	**TERM THREE**	
12. Trigonometry - Compound Angle Formulae - Factor Formulae 13. Solution of Triangle Vectors	14. Probability Theory 15. Permutations and Combinations	16. Friction 17. Newton's Laws of Motion
SENIOR SIX	**TERM ONE**	
18. Integration - Definite and Indefinite Integrals - Area under a Curve 19. Displacement, Velocity and Acceleration 20. Series - Arithmetic Progression - Geometric Progression	21. Random Variables - Discrete Random Variables - Continuous Random Variables - 22. Binomial Distribution	23. Work, Energy, Power
SENIOR SIX	**TERM TWO**	
24. Matrices and their Applications	25. Normal Distribution	
SENIOR SIX	**TERM THREE**	
26. Differential Equations		

SENIOR FIVE TERM ONE

PURE MATHEMATICS

Topic 1: The Scientific Calculator

Duration: 4 Periods

Background

A calculator is a digital device widely used to perform mathematical calculation. However, learners do not always use it effectively. Sometimes they use it inappropriately. Throughout this topic, the learner is expected to learn how to use a scientific calculator efficiently.

Learning Outcome

The learner should be able to use a scientific calculator to carry out mathematics calculations more effectively.

Sub-Topic: Mathematical Operations

Competences	Content
The learner: • identifies keys for various mathematical operations on a calculator. • uses a calculator to evaluate algebraic expressions (3-5 digits) • uses a calculator to evaluate mathematics expressions with mixed operations (up to 8 digits)	• The four operations $+$, $-$, $\times$, $\div$ • Other operations: Inx *or* $\log_e x$ $\sqrt{x}$, $\log x$, $\sqrt[x]{y}$, x^y, trigonometric functions • Mixed operations (using BODMAS)

Teaching/Learning Strategies

- Guide learners on rounding up figures to the required degree of accuracy.
- Through peer presentation, learners practice and guide one another to use a calculator.

Guidance to the Teacher

- Encourage learners to have personal non programmable scientific calculators. It is advisable for the ease of teaching that learners use the same type of calculator.
- Algebraic expressions with mixed operations should include expressions with parenthesis, fractions and other operations mentioned in the content column.
- As a school, you are advised, as much as possible, to use the same type of calculator to ease the teaching and learning process.
- Ensure learners can give answers to the required degree of accuracy.
- Introduce the use of the word “exponent” and its symbol (^). The symbol should not be used in their answers.
- Review the concept of standard form and significant figures learnt at O Level.

Topic 2: Indices, Logarithms and Surds

Duration: 14 Periods

Background

Indices, logarithms and powers mean the same thing and can be used interchangeably. Quite often we encounter very big and very small numbers e.g. the distance from the earth to other planets and the size of a molecule or atom. Indices and logarithms help us to deal with such numbers more conveniently. Surds are irrational numbers which can be expressed as powers.

Knowledge of logarithms is:

i) essential for further learning in other related subjects.

ii) used to make predictions of, e.g. population growth, rate at which a disease spreads.

iii) commonly used to multiply and divide large numbers.

Learning Outcome

The learner should be able to simplify and evaluate expressions involving logarithms, indices and surds.

Sub-Topic 1: Indices

Competences	Content
The learner: • relates powers to indices. • applies the laws of indices. • simplifies expressions using laws of indices. • solves equations that require use of laws of indices.	 • Powers as indices • Laws of indices • Simplifying expressions • equations that require use of laws of indices

Learning/Teaching Strategies

- Through multiplying the number by itself, guide the learners to use powers.

- Use the division approach to introduce negative powers.
- In groups or individually use the laws of indices to simplify expressions and solve equations.

Sub-Topic 2: Logarithms

Competences	Content
The learner: • relates logarithms to indices. • applies laws of logarithms to numbers • changes from one base to another. • simplifies logarithmic expressions in different bases. • solves equations involving bases and logarithms	 • Logarithm as an index • Laws of logarithms • Change of base • Simplification of logarithmic expressions • Simple equations involving indices and logarithms

Teaching/Learning Strategies

- Through exposition, guide the learners to state the laws of logarithms.
- Provide worksheets for learners to practice application of the laws of logarithms, simplify and evaluate expressions.

Sub-Topic 3: Surds

Competences	Content
The learner: • identifies rational and irrational numbers. • identifies and simplifies numbers in surd form. • rationalises surds. • solves simple linear equations with surds. • performs operations (adds, subtracts multiplies).	 • Rational and irrational numbers • Simplification of surds • Rationalisation of surds • Simple equations involving surds

Teaching/Learning Strategies

- Through teacher exposition, define rational numbers with examples and explain the significance of rationalisation.
- Guide learners to rationalise the denominator.
- Provide worksheets/activities for learners to practise and develop skills in rationalising the denominator.

Guidance to the Teacher

- Students should be taken through this topic slowly because the content is abstract. Guide the learners to identify where this knowledge can be applied.
- Where applicable, let the learners understand how the laws of indices and logarithms are applied.
- Some learners could be well versed with this topic. Group the learners and distribute fast learners to tutor the rest during group activities. Emphasise on group presentations so that the weak learners get more time to internalise the content and the approaches used.
- The required level of accuracy should not exceed four significant figures unless otherwise stated in a particular question or situation.

Topic 3: Polynomials

Duration: 6 Periods

Background

Polynomials are algebraic expressions that include real numbers and variables. They contain more than one term. Polynomials are the sums of monomials.

A monomial has one term for example $5y$ or $-8x^2$ or 3 are monomials.

A sum of two monomials which are not like terms for example; $3x^2+8$, or $9y+y^2$, is a special polynomial called a binomial. Similarly, a sum of three monomials is a trinomial for example; $3x^2+8x+5$.

The degree of the polynomial is the highest exponent of the variable for example; $3x^2$ has a degree of 2, $3x^5+5x$ has a degree 5. When the variable does not have an exponent, always understand that there is a '1' e.g., $3x$ *is the same as* $3x^1$.

A polynomial of degree n in a variable x is a sum of any number of monomials and has the following form $a_n x^n + a_{n-1}x^{n-1} + ... + a_1 x + a_0$ where the coefficients a_k, $[k = n-1,\ n-2, \ldots, 0]$, are constants. a_k may be zero, positive or negative, a_n **not** zero.

Learning Outcome

The learner should be able to simplify and evaluate expressions involving polynomials.

Sub-Topic: Polynomials

Competences	Content
The learner: • forms polynomials. • identifies the order of a polynomial.	• Formation of polynomial • Order of a polynomial

Competences	Content
• performs operations on polynomials.	• Operations on polynomials (addition, subtraction, multiplication and Division)
• evaluates polynomials at a given point by substitution.	• evaluation of a polynomial
• factorises polynomials.	• Factorisation of polynomials up to degree 2
• solves simple polynomials.	• Solving a polynomial

Teaching/ Learning Strategies

- Guide the learners to identify monomials and binomials.
- Allow learners to form polynomials using knowledge from the teacher exposition.

Guide learners through multiplication and division of polynomials.

Guidance to the Teacher

- Polynomials can be formed by using sides of a regular object say; a rectangle, whose sides are given in form of monomials. Allow learners to find the perimeter as a way of forming polynomials from monomials. The same methodology can be used to introduce subtraction multiplication and division of polynomials if the sides of a regular object are given as polynomials.
- A Polynomial $p(x) = a_n x^n + a_{n-1} x^{n-1} + ... + a_1 x + a_0$ can be expressed as a function

  $f(x) = a_n x^n + a_{n-1} x^{n-1} + ... + a_1 x + a_0$, [a_n **not** zero]

- You should emphasise to learners that $f(x)$ is **not** 'f multiplied by x' **but** means the 'value of the expression' for example: $f(a)$ means 'the value of the expression when $x = a$.

PROBABILITY AND STATISTICS

Topic 4: Descriptive Statistics

Duration: 20 Periods

Background

Statistics is a set of concepts, rules, and procedures that help us to:

- **organise** numerical information in the form of tables, graphs, and charts;
- **understand** statistical techniques underlying decisions that affect our lives and well-being; and
- **make** informed decisions basing on information generated from processed data.

Statistics plays a vital role in every field of human activity. For example, it has an important role in determining the existing position of per capita income, unemployment, population growth rate, housing, schooling, medical facilities, etc, in a country. Statistics is a vital tool in fields like industry, commerce, trade, Physics, Chemistry, Geography, Economics, Mathematics, Biology, Botany, Psychology, and Astronomy. Statistical methods are used in research to collect, analyse, and formulate research findings in every field at higher institutions of learning.

Learning Outcome

The learner should be able to collect, present and analyse or interpret data using measures of central tendency and measures of dispersion.

Sub-Topic 1: Introduction to Statistics

Competences	Content
The learner: • identifies discrete and continuous data with examples. • identifies ungrouped and grouped data. • groups data.	• Discrete and continuous raw data • Types of data: - ungrouped data - grouped data

Teaching/ Learning Strategies

- Guide learners to collect data for example they can take measurements of their height, waist, fingers, shoe size or any other variable.
- Guide learners to group their data.

Sub-Topic 2: Organisation of Data

Competences	Content
The learner: • identifies data presentation methods. • selects a suitable way of presenting raw statistical data. • presents data using any of the methods including a frequency distribution table for ungrouped and grouped data. • interprets statistical diagrams.	• Data presentation methods: - Frequency tables - Histograms • Cumulative frequency graph (Ogive) • Interpretation of statistical diagrams (Frequency tables, Histograms and Ogives)

Teaching/ Learning Strategies

- Guide learners on different forms of data presentation.
- In groups or individually, guide learners to make presentations of their data making use of various charts and diagrams.

Sub-Topic 3: Measures of Central Tendency

Competences	Content
The learner: • calculates the mean , mode and median of grouped data. • estimates the mode using the histogram. • estimates the median using the Ogive. • uses different measures of central tendency (mean, mode, median) to analyse data.	• Mean, mode and median

Teaching/ Learning Strategies

- Using a number of examples from practical examples, guide the learners to calculate measures of central tendency.
- Guide learners to compare and contrast sets of data and make meaningful conclusions on the data collected at the beginning of the topic.
- Guide learners on use of a calculator for statistical computations.

Sub-Topic 4: Measures of Variation (Dispersion)

Competences	Content
The learner: • determines the range. • uses the Ogive to estimate the quartiles, percentiles and interquartile range. • calculates the variance and standard deviation. • analyses data using variance and standard deviation.	• Range • Quartiles/percentiles • Variance and standard deviation • Data analysis

Teaching/ Learning Strategies

- Guide learners to determine measures of dispersion.
- Guide learners to use measures of dispersion to make conclusions on sets of data.
- Guide learners on use of a calculator for statistical computations

Guidance to the Teacher

- At this level, most learners would have had some reasonable background knowledge on this topic. The methodologies used should aim at clarifying concepts already learned.
- You are advised to teach this topic as a project covering areas of data collection, presentation and analysis.
- Data presentation and analysis should look at constructing histograms (with equal class widths only).

- You should use the data familiar to the learner's environment. This way you will help learners create interest in the topic/subject.
- You should also focus on the ability to interpret graphs and charts and the importance of central tendency values.
- Train the learner to use different measures of variation (dispersion) in comparing and contrasting sets of data.
- A histogram is a special bar graph with the heights of the bars representing the frequencies of the groups and NO gaps between the bars.
- While dealing with practical activities, guide learners to use suitable scales and label the axes properly. Shading of the histogram is not important but if used it should be uniform.
- If computers are available, guide learners to use statistical packages to perform calculations and generate graphs and charts.

MECHANICS

Topic 5: Resultants and Components of Forces

Duration: 12 Periods

Background

A force vector can be expressed in two dimension on the $(x,\ y)$ plane, for example, imagine the surface of a table top to be an $(x,\ y)$ plane. Objects can be pushed across this table surface in several different directions, not just parallel to the length or width of the table. Objects can be pushed across a table top at a slanted direction relative to the edges of the table top.

A force may be thought of as having a part that pushes right or left, and another part that pushes up or down.

This is used in many applications that require use of forces such as navigation, constructions and lifting/moving objects in daily life.

Learning Outcome

The learner should be able to resolve and determine resultants of a system of forces in a plane.

Sub-Topic 1: Resultant of Forces

Competences	Content
• The learner determines the resultant of parallel and non parallel forces.	• Resultant of: - parallel forces - non parallel forces - any number of forces

Teaching/ Learning Strategies

- Start with practical examples that have parallel forces.

Sub-Topic 2: Components of a Force

Competences	Content
The learner: • resolves a force in two perpendicular directions. • applies resolution of forces to find the resultant force.	• Components of a force • Resultant of a number of forces.

Teaching/ Learning Strategies

- Guide learners to resolve forces in two perpendicular directions.
- Let the learners use trigonometrical ratios of sine and cosine.

Guidance to the Teacher

- Use of vector notation $\mathbf{i}, \mathbf{j}, \mathbf{k}$ is beyond the scope of this topic.
- Forces that require resolving along an inclined surface are not expected. All resolutions should stick to components in two perpendicular directions. Use of arrows to show the directions of components is important.
- The number of forces acting at a point should not exceed five (5).

SENIOR FIVE TERM TWO

PURE MATHEMATICS

Topic 6: Differentiation

Duration: 12 Periods

Background

In mathematics, differential calculus is a subfield of calculus concerned with the study of the rates at which quantities change. It is one of the two traditional divisions of calculus, the other being integral calculus.

The primary objective of studying in differential calculus is the derivative of a function, related notions such as the differential, and their applications. The derivative of a function at a chosen input value describes the rate of change of the function near that input value. The process of finding a derivative is called differentiation. Geometrically, the derivative at a point equals the slope of the tangent line to the graph of the function at that point. For a real-valued function of a single real variable, the derivative of a function at a point generally determines the best linear approximation to the function at that point.

Differential calculus and integral calculus are connected by the fundamental theorem of calculus, which states that differentiation is the reverse process to integration.

Knowledge of differentiation is applicable in analysis of finance and economics. One important application of differentiation is in the area of optimisation, which means finding the condition for a maximum (or minimum) to occur. This is important in business (cost reduction, profit increase) and engineering (maximum strength, minimum cost).

Determination of the **maximum** and **minimum** points is a valuable aid in sketching a curve. **Maximum** and **minimum** points are also known as **turning points** of a curve. The first derivative is used to identify these turning points of the curve. Finding maximum and minimum can be applied to maximise revenue and profit and to minimise average cost when the appropriate functions are known. Maximising also helps us in optimisation

say in production and consumption, to test for sufficiency in production and consumption, monopoly markets and the like.

We shall also apply differentiation technique to find the relationship between displacement, velocity and acceleration.

Learning Outcome

The learner should be able to obtain derivatives of simple polynomials including finding the gradient of a line from the equation $y = mx + c$.

Sub-Topic 1: Derivative of a Function

Competences	Content
The learner: • differentiates polynomials. • determines the gradient of a line. • determines the gradient of a curve/function at a given point.	• Derivatives of polynomials • Gradient of a line. • Gradient of a curve

Teaching/ Learning Strategies

- Through teacher exposition, guide learners to use the notations $\frac{dy}{dx}$ and $f'(x)$.
- Take learners through the process of determining derivatives of polynomials.
- Allow learners time to practice how to determine derivatives of a function and slope of a curve at a point and also conduct peer presentation.

Sub-Topic 2: Second Derivative

Competences	Content
• The learner finds the second derivative using the notations $f''(x)$ or $\frac{d^2y}{dx^2}$.	• Second derivative

Teaching/ Learning Strategies

- Through exposition the teacher relates the first derivative to the second derivative.

Sub-Topic 3: Curve Sketching

Competences	Content
The learner: • uses intuition to sketch quadratic curves. • finds the turning points. • uses in table form the sign of the first derivative to determine the nature of the turning points. • uses the second derivative to distinguish between the maximum and minimum points. • sketches the curves. • uses differentiation to find solutions of word problems.	• Maximum and minimum points. (Do not include points of Inflexion) • Curve sketching

Teaching/ Learning Strategies

- Make a review of the shapes of quadratic curves through by sketching several curves.
- Prepare work on functions to be differentiated by the learners and find the roots for which the first derivative is zero.
- Through exposition, help the learners on how to use the signs of the gradients of the tangents.
- Through guided discovery, let the learners find out the nature of the turning points using the sign change method. (Second derivative)
- Through guided discovery, help the learners to sketch the curves.
- Through question and answer, let the learners use differentiation to solve word problems.

Guidance to the Teacher

- Use other variables like change in profit with change in number of employees to allow learners develop their own understanding of a derivative of a function, differentiation and rate of change.
- For a function $y = ax^n$, the formula $\frac{dy}{dx} = nax^{n-1}$ can be used to guide learners obtain derivatives of simple algebraic functions e.g. x^2, $3x^2$, $4x^3 \pm 2x^2$
- The variables x and y may be replaced by any other relevant variables.
- Differentiation of polynomials from first principles is not necessary.
- Use of product and quotient rule is not expected at this point.
- The second derivative should be mentioned. DO NOT mention distinguishing of the nature of the turning points at this point, but strictly lead the learners to only find the second derivative of simple functions. For example: Find the second derivative of:

  i) $y = 3x^3 + 4x^2 + 5$ ii) $y = 3x^4 + 8x^3 - 4x^2 + 5x + 7$

  ii) Emphasise on the difference between **sketching** and **plotting** a curve.

  iii) Remind the students about the general shape of the graph in the form $y = ax^2 + bx + c$ for $a \langle 0$ land $a \rangle 0$.

  iv) Expose the learner to real life situations.

Topic 7: Quadratics

Duration: 8 Periods

Background

Quadratic expressions are polynomials in which the highest power/degree of the variable is 2. A general quadratic expression in x is in the form $ax^2 + bx + c$ and the corresponding general quadratic equation takes on the form $ax^2 + bx + c = 0$ where a, b, c are constants and a is a non-zero integer. The solutions (values of x) for $ax^2 + bx + c = 0$ are referred to as **roots** of the equation. Applications of quadratics include, determining the trajectory of a projectile and expressing Production functions, Cost functions and Utility functions.

Learning Outcome

The learner should be able to apply knowledge of quadratic expressions.

Sub-Topic: Quadratic Equations

Competences	Content
The learner: • solves quadratic equations using factorisation and completing squares. • identifies the roots of a given quadratic equation. • forms quadratic equations using given roots. • solves the equations involving indices. • solves simple equations reducing to quadratics. • interprets roots • identifies/finds minimum/maximum values by	• Methods of solving quadratic equations • Sum and product of roots of a quadratic equation • Formation of quadratic equations • Equations reducing to quadratics • Maximum and minimum

Competences	Content
completing squares	values (of the quadratic function)

Teaching/ Learning Strategies

- Guide the learners to discover the different methods of solving quadratic equations i.e. graphical method, factorisation, use of formulae, completing squares.
- Guide the learners to use the discriminant to determine whether an equation has real roots.

- Use the method of completing the square to determine the maximum and minimum values of a quadratic expression.
- With students ensure students can sketch identify graphs of quadratic function.

Guidance to the Teacher

- Formation of equations that require use of symmetrical functions is beyond the scope of this syllabus.
- Remind the learners of the use of the identities at O Level where applicable.

$$x^2 - y^2 = (x + y)(x - y)$$
$$(x \pm y)^2 = (x^2 \pm 2xy + y^2)$$
$$(x + a)(x + b) = x^2 + (a + b)x + ab$$

- Consider situations where not all the two roots of a quadratic equation may be applicable.

STATISTICS

Topic 8: Moving Averages

Duration: 8 Periods

Background

Moving averages is one of the methods used in business and other areas of life for forecasting numerical data. Forecasting gives a business the opportunity to plan for the future as well as planning for several changes. It is important to have an idea about the **trend**, that is, the underlying movement of the data in consideration. For example, there could be particular points during a year when sales are lower than previous time periods. The time period could be seconds, minutes, days, weeks, months, years, decades.

The process of moving averages means the averages are taken from the data.

Learning Outcome

The learner should be able to use data to forecast the trend.

Sub-Topic: Moving Averages

Competences	Content
The learner: • identifies the trend. • calculates odd or even moving totals. • uses these totals to calculate odd or even moving averages. • plots the moving averages. • uses the graph to forecasts the trend.	• The cycle of the data • Even and odd moving totals • Odd and even moving averages • Graphs of moving averages

Teaching/ Learning Strategies

- Guide the learners in identifying the cycle if not stated.

- Learners practise to calculate moving totals and the corresponding moving averages depending on the cycle.
- Guide learners to plot graphs of moving averages.

Guidance to the Teacher

- Moving averages requires a student to have knowledge about **extrapolation** which is vital for forecasting.
- Calculations are better done when in tabular form.

Topic 9: Index Numbers

Duration: 6 Periods

Background

Index numbers are statistical economic indicators which provide a measure of the relative change in some variable or group of variables at a specified date when completed with some fixed period in the past.

Index numbers are also widely used by business operators, to evaluate their trading positions in relation to competitors and rely on the national indices for wages, production, prices, sells, transport charges and share prices to provide simple background information against which objective decisions may be taken. For instance, they may be used to compare the present agricultural production or industrial production, price fluctuations of commodities, with those of the past years.

The simplest example of an index number is a **price relative** or **price index**. A **base year** is always chosen and this is the year on which the price changes are based.

For a price index to be realistic it should take into account the relative importance of the commodities. The method of **weighting** is used to cater for this.

Learning Outcome

The learner should be able to calculate simple and weighted price index numbers and use them to compare relative changes in a particular situation.

Sub-Topic: Index Numbers

Competences	Content
The learner: • calculates the price index. • calculates the: - simple price index number.	• Concept of price indices (price relatives) • Un-weighted price indices • Weighted price index:

Competences	Content
- simple aggregate price index. • calculates the: - weighted price index. - weighted aggregate price index. • determines the value index.	- Weighted aggregate price index. - Value index

Teaching/ Learning Strategies

- Through exposition, define the basic terminologies used e.g. Base year, Current year.
- Engages the learners in tasks to use the formula to calculate the simple price index number and simple aggregate price index.
- Provides activities to the learners to practice and develop skills to calculate the weighted price index and weighted aggregate price index.
- Through explanation, guides the learner to draw conclusions using the calculated index numbers.

Guidance to the Teacher

- Emphasise that when we are given the number, such as 120, referring to a price index, the learner must remember that the % sign is implied, that is to say the learner must use 120% or 1.2 in the calculation.
- You are advised to use Business/ Economics textbooks.

Topic 10: Correlation

Duration: 10 Periods

Background

Scatter diagram is a tool for analysing relationships between two variables. One variable is plotted on the horizontal axis and the other is plotted on the vertical axis. The pattern of their intersecting points can graphically show relationship patterns. Scatter diagrams are used in research to investigate relationships between two variables such as cause-and-effect relationships.

Learning Outcome

The learner will be able to interpret scatter diagrams for bivariate data and use it to draw suitable conclusions.

Sub-Topic: Scatter Diagrams

Competences	Content
The learner: • determines the nature of correlation between variables. • draws scatter diagrams and line of best fit. • determines coefficient of correlations. • draws conclusion using the coefficient of correlation.	• Concept of correlation • Scatter diagrams • Rank correlation coefficient • Applications of coefficient of correlation

Teaching/ Learning Strategies

- Prepare a project for learners to investigate the correlation between two variables.
- Guide learners to plot a scatter diagram, draw line of best fit, and use it to make conclusions.
- Guide the learner to calculate the correlation coefficient using Spearman's coefficient of rank correlation (r_s).

Guidance to the Teacher

You are advised to prepare a worksheet to guide learners to investigate the relationship between two variables.

MECHANICS

Topic 11: Motion in a Straight Line

Duration: 6 Periods

Background

Mechanics is a branch of the physical sciences concerned with the state of rest or motion of bodies that are subjected to the action of forces. A body is said to be in motion if its position changes with time. The position of the object can be specified with respect to a conveniently chosen origin. A number of terms are used to describe motion in a straight line. These include, speed, velocity, displacement, distance, instantaneous rest and time taken.

In most cases, speed is referred to even if it is velocity. Speed should be differentiated from velocity and distance differentiated from displacement.

Knowledge acquired in this topic is required to plan journeys especially when integrated with map reading.

Learning Outcome

The learner should be able to plan journeys and determine missing variables for any journey using equations of motion.

Sub-Topic: Distance, Velocity and Acceleration

Competences	Content
The learner: • differentiates: - distance from displacement. - speed from velocity. • sketches and interprets displacement-time graphs. • sketches and interprets velocity-time graphs • applies equations of linear motion	• Distance, displacement, velocity, speed, average speed, acceleration • Displacement-time graphs • Velocity-time graphs

Competences	Content
to solve mathematical problems.	• Equations of linear motion • Numerical problems

Teaching/ Learning Strategies

- Brainstorm with learners the difference between speed and velocity; displacement and distance.
- Guide learners to present linear motions graphically.
- Provide a variety of graphs for learners to interpret and draw inferences.
- Using appropriate graphs, guide learners to derive equations of motion.
- Relate the gradient of a distance-time graph to speed and the gradient of the velocity time graph to acceleration.
- Provide learners worksheets to practice solving numerical problems.

Guidance to the Teacher

- Help the learners to:
  i) identify distance and speed as scalar quantities; displacement, velocity and acceleration as vector quantities.
  ii) sketch and interpret displacement-time graphs and velocity-time graphs, and in particular appreciate that:
    - the area under a velocity-time graph represents displacement.
    - the gradient of a displacement-time graph represents velocity.
    - the gradient of a velocity-time graph represents acceleration.
- Derivation of equations of motion is not necessary. The learner needs to simply quote and use them.

SENIOR FIVE TERM THREE

PURE MATHEMATICS

Topic 12: Trigonometry

Duration: 18 Periods

Background

Trigonometry is a branch of mathematics that studies the relationship between the three sides and the three angles of a right angled triangle in terms of ratios and representing them as trigonometrical ratios; sine, cosine and tangent. It was developed for astronomy and geography, but scientists have been using it for centuries for other purposes, too.

Knowledge of trigonometry is applicable in fields like land surveys, engineering and navigation.

Learning Outcome

The learner will be able to use trigonometry to solve problems involving circular functions and triangular shapes.

Sub-Topic: Trigonometrical Ratios

Competences	Content
The learner: • writes down the six trigonometrical ratios using a right angled triangle. • obtains the trigonometrical ratios for the special angles. • obtains the trigonometrical ratios for any angle (positive and negative)	• Expressions of the six trigonometrical ratios • Special angles of 0^o, 30^o, 45^o, 60^o and 90^o. • Trigonometrical ratios of $90^o \pm \theta$, $180^o \pm \theta$, $-\theta$

Competences	Content
• deduces the sine, cosine, tangent of an angle of any magnitude using the quadrants of a unit circle. • sketches trigonometrical graphs. • uses Pythagoras theorem to derive trigonometrical identities. • evaluates and simplifies trigonometric expressions.	• Graphs of $\sin\theta$ and $\cos\theta$. • The ratios of sine, cosine, tangent and their reciprocals, cosecant, secant, cotangent, respectively). • Trigonometric identities: $\sin^2\theta + \cos^2\theta = 1$ $\tan^2\theta + 1 = \sec^2\theta$ $\cot^2\theta + 1 = \cos ec^2\theta$ • Trigonometric expressions • Equations

Teaching/ Learning Strategies

- Guide the learners to form trigonometrical ratios from right angled triangles.
- Surd form of the trigonometrical ratios for special angles should be derived and simplified using appropriate triangles.
- Sketching graphs of the trigonometric functions ($\sin\theta, \cos\theta$) should be a learner-centred activity.
- Guide the learners on how to obtain all the possible angles in the given range.
- Guide the learners to evaluate and simplify trigonometric expressions without using tables or calculators and recognising max/min of simple expressions.
- Group work activity should be encouraged when deriving trigonometrical identities to emphasise learner participation.

Guidance to the Teacher

- Use of parenthesis to write double angle and compound angles should be emphasised.

Common mistakes

- When solving trigonometrical equations, learners cancel trigonometrical ratios instead of factorizing them. This leads to loss of some values of θ required in the given range, e.g.

  $\cos\theta + 2\sin\theta\cos\theta = 0$. In this case learners cancel out $\cos\theta$ instead of factoring it out.
- Guide the learners on how to obtain all the possible angles in the given range.
- Trigonometric functions $\sin x$, $\cos x$ and $\tan x$ are usually referred to as circular functions. Knowledge about their domains and range: their periodic nature is recommended.
- Guiding students to get solutions graphically may be essential.
- On examination papers, radian measure should be assumed unless otherwise indicated. For example $f(x) = \sin x^o$.
- Given $\sin\theta$, ensure learners can find possible values of $\cos\theta$ and $\tan\theta$ without finding θ.
- Lines may be expressed as $y = x\tan\theta + c$: $\tan\theta$ is the gradient.
- Most learners interpret the cosine rule wrongly, i.e., $a^2 = b^2 + c^2 - 2bc\cos A$, when computing, students often write it as $a^2 = (b^2 + c^2 - 2bc)\cos A$, so you are encouraged to emphasise $a^2 = b^2 + c^2 - (2bc\cos A)$

Topic 13: Vectors

Duration: 10 Periods

Background

A vector may be described as a quantity associated with a particular direction in space. Any vector may be represented by a directed line segment, whose direction is that of the vector and whose length represents the magnitude of the vector. Displacement is one of the simplest examples of a vector. Vectors can be added together (vector addition), subtracted (vector subtraction) and multiplied by scalars (scalar multiplication). A vector from a point A to a point B is denoted $\vec{AB}$. If coordinates are involved, we use x, y in 2 – dimensions, the unit vectors in the respective directions are $\mathbf{i}$, $\mathbf{j}$. Any other quantity with only magnitude is known as **a scalar** quantity.

Vectors are applied in various fields of science, mechanics that involve magnitude (size) and direction, for example, displacement, velocity, force, acceleration, have a size or magnitude, but also they have associated with them the idea of a direction. Vectors are also employed in navigation by people who operate ships and aircrafts.

Learning Outcome

The learner should be able to carry out mathematical operations involving vectors in 2 – dimensions; compute the angle between two given vectors and interpret appropriate quantities.

Sub-Topic: Vectors in 2 Dimensions

Competences	Content
The learner: • expresses a vector in a column form $\begin{pmatrix} x \\ y \end{pmatrix}$. • writes a column vector in the form $a\mathbf{i} + b\mathbf{j}$.	• Vector notations

Competences	Content
• determines the displacement vector.	• Displacement vector
• identifies a position vector.	• Position vector
• adds and subtracts vectors.	• Addition and subtraction of vectors
• multiplies a vector by a scalar.	• Multiplication by a scalar
• calculates the magnitude of a vector.	• Magnitude and direction of a vector
• determines a unit vector in a given direction.	• Unit vector
• identifies parallel vectors.	• Parallel vectors
• identifies equal vectors.	• Equal vectors
• finds the dot products of two vectors.	• Dot/scalar product of two vectors
• finds the angle between two vectors.	• Angle between vectors
• identifies perpendicular vectors.	• Perpendicular vectors
• applies vector algebra to simple navigation problems.	

Teaching/Learning Strategies

- In groups, guide the learner to apply the vector notations when representing given problems.
- Prepare work on determining the displacement vector and position vector.
- Engage learners in tasks in vector addition, subtraction and scalar multiplication.
- Involves the learners with exercises to find the magnitude of a vector using the formula $|\mathbf{P}| = \sqrt{x^2 + y^2}$.
- Through exposition, explain how to calculate the angle between two vectors by use of the dot product.

Guidance to the Teacher

- Help the learners to identify scalar quantities and vector quantities.
- You are advised to concentrate more on vectors in two dimensions particularly displacement vectors.
- You should make the students aware that the sum of two or more vectors is the "resultant" vector. Direction of a vector should be restricted to 2 – dimensional vectors **only**.

PROBABILITY AND STATISTICS

Topic 14: Probability Theory

Duration: 10 Periods

Background

Probability theory is the branch of mathematics concerned with prediction and uncertainty. It was developed from the theory of games of chance and gambling. It plays a very important role in astronomy, physics, chemistry, engineering, economics, business, social science, psychology and research.

The probability of an event is the measure of the likelihood that it will occur and it is given on a numerical scale from 0 to 1.The numbers representing probabilities can be written as percentages, fractions or decimals.

A probability of **zero** implies that the event is **impossible**.

A probability of **one** (100%) indicates that the event is **certain to occur**.

All other events have a probability between zero and one.

A probability event consists of one or more outcomes of a probability experiment. Two events: A and B are said to be **mutually exclusive** if they cannot occur at the same time. Events can also be classified as **independent** or **dependent**. Independent events are events such that the occurrence of one does not affect the occurrence of the other.

The **complement** of an event is the set of outcomes of the event in the sample space that are not included in the outcomes of the event itself.

The **conditional probability** of an event B in relation to an event A is the probability that event B occurs after event A has already occurred.

Probability problems can be worked out by using the addition rules, the multiplication rules and the complementary event rules.

Learning Outcome

The learner should be able to calculate probabilities from give/researched data and draw out relevant conclusions, as well as solve problems involving probability.

Sub-Topic: Probability Theory

Competences	Content
The learner: • lists down the possible outcomes of an event in the experiment. • finds probability of an event using classical probability formula. • uses Venn diagrams to solve probability problems. • determines the number of outcomes to a sequence of events using tree diagrams. • finds the probabilities involving independent events using the multiplication rule. • computes the probabilities involving mutually exclusive events using the additive rule. • calculates numerical problems related to conditional probability.	• Experimental probability • Terminologies in probability theory • Probability laws and notations in relation to set theory • Contingency table • Probability tree diagrams • Mutually exclusive and independent events • Probability situations i.e. AND and OR • The conditional probability

Teaching/Learning Strategies

- Expose the learners to the knowledge about the probability theory through group work and experiments on a die and a coin.
- Brainstorm on the use of the terminologies and notations in probability theory.
- Guide the learners to state and apply the laws of probability to related problems.

- Use the contingency table to workout probabilities.
- Use Venn diagrams to illustrate events.
- In groups or individuals, let learners show how probability tree diagrams are constructed from relevant data and their application.

Guidance to the Teacher

- Encourage learners to make use of Venn diagrams when explaining the concept of probability.
- Use of O level knowledge and textbooks is recommended.
- Emphasise the application of the probability laws i.e. (i) $0 \leq P(A) \leq 1$
- (ii) $P(A) + P(\overline{A}) = 1$ to related problems.
- Picking with OR without replacement should be restricted to only 2 pickings.

Topic 15: Permutations and Combinations

Duration: 6 Periods

Background

Many problems in probability and statistics require a careful analysis of the outcomes of the events. A sequence of events occurs when one or more events follow one another. Many times one wishes to list the sequence of events, and can use several rules of counting which may include the permutation rules and the combination rules.

We always try to arrange given objects in our homes, shops, schools and elsewhere in different ways for some reasons such as convenience and neatness. A **permutation** is an arrangement of distinct objects in a specific order. For example, suppose a photographer must arrange three girls: Ann (A), Bena (B) and Halima (H) in a row for a photograph. He can do this in six possible ways: $\{A, B, H\}, \{A, H, B\}, \{B, A, H\}, \{B, H, A\}, \{H, A, B\}$ and $\{H, B, A\}$.

A **combination** is the number of ways of selecting a group of objects from a given set of objects, e.g. an A level subject combination such as HEG, PCB, etc. In a combination, the order of selection is not important, that is GEH, GHE, HGE, EGH, EHG are all the same as HEG. The difference between a permutation and a combination is that in a combination, the order or arrangement of the objects is not important.

Learning Outcome

The learner should be able to determine the number of permutations or combinations of a given set of objects.

Sub-Topic 1: Permutations

Competences	Content
The learner: • arranges items in a row. • identifies a permutation.	• Arrangement of objects in a row • Concept of permutation

Competences	Content
• relates the number of permutations to the factorial notation. • uses the permutation formula of to find the number of ways that *r* can be selected from *n* objects.	• Factorial notation *n*! • Permutation notation ${}^{n}P_{r}$ and the formula ${}^{n}P_{r} = \frac{n!}{(n-r)!}$

Teaching/Learning Strategies

- Through exposition, guide the learners to arrange objects in a row.
- Explain the concept of permutation and how to use the formula ${}^{n}P_{r} = \frac{n!}{(n-r)!}$.
- In groups, guide the learners to arrange different objects in a row, then in a circle.

Sub-Topic 2: Combinations

Competences	Content
The learner: • identifies the characteristics of a combination. • applies the combination notation and formula to solve related problems.	• Ways of selecting objects • Identify a combination • Combination notation $\binom{n}{r}$ *or* ${}^{n}C_{r}$ and the formula ${}^{n}C_{r} = \frac{n!}{(n-r)!\,r!}$

Teaching/Learning Strategies

- Discuss with the learners their subject combinations.
- Through exposition, explain the combination notation

- Guide the learners with examples on how to use the formula ${}^{n}C_{r} = \frac{n!}{(n-r)!\,r!}$ to compute different combinations.

Guidance to the Teacher

- Encourage to use the objects around the classroom like books, chairs, students, boxes and playing cards to illustrate different arrangements and selections.
- For systematic grouping of objects, you may use O level subjects to pick the subject combinations with or without restriction.
- Only simple cases of permutations and combinations should be considered for example formation of a committee from a group of members of the same or different sex.

MECHANICS

Topic 16: Friction

Duration: 6 Periods

Background

Friction is the force which opposes relative motion between two bodies in contact. The magnitude of the frictional force is just sufficient to prevent relative motion.

Suppose a horizontal force says P is applied to a body on a rough horizontal table, the body does not necessarily move. There is a frictional force say F that opposes the applied force P. This frictional force F for a particular surface is not constant. It increases as the applied force **P** increases until the force F reaches a maximum force $\mathbf{F_{max}}$ beyond which it cannot increase.

When the body is just about to move, it is then said to be in a **state of limiting equilibrium**. At this point $F_{\max} = \mu R$ where μ is the coefficient of friction and R is the normal reaction. When the body starts to move, the frictional force F takes its limiting value μR and acts in the direction opposite to that of relative motion.

Learning Outcome

The learner should be able to draw and use simple diagrams to find the magnitude of the frictional force acting on any body either at rest or in motion.

Sub-Topic: Friction

Competences	Content
The learner: • lists the forces acting on a body placed on a rough horizontal surface. • relates limiting equilibrium to maximum friction force.	• Concept of friction • Limiting equilibrium

Competences	Content
• calculates the frictional force using $F = \mu R$ • calculates the coefficient of friction between the body and an inclined plane using $F = \mu R$. • applies the laws of friction to different situations. • calculates the friction force or any other force acting on the body moving on: - Horizontal plane - Inclined plane	• Coefficient of friction • Friction on horizontal surfaces and inclined planes

Teaching/Learning Strategies

- With the aid of a diagram explain the forces acting on a body on a horizontal rough surface.
- Carry out a discussion on the terminologies: limiting equilibrium and coefficient of friction.
- With the aid of worked out examples, guide the learners to calculate frictional force on an object using simple diagrams on both the horizontal surfaces and inclined planes.

Guidance to the Teacher

- Let the learner identify where friction is applied in daily life.
- Guide the leathers to explain the advantages and disadvantages of friction.
- Use the knowledge they acquired from their O level physics lessons.

Topic 17: Newton's Laws of Motion

Duration: 6 Periods

Background

The three Newton's laws of motion, namely; **Newton's first law** states that a body will remain at rest or will continue to move with constant velocity in a straight line unless acted upon by a resultant force. **Newton's second law** states that the resultant force on a body is directly proportional to the rate of change of momentum of a body. **Newton's third law** states that every action has an equal and opposite reaction. The three laws are used in the theory of elementary **Dynamics**. They deal with the effect of forces acting on a body in motion. Common bodies include vehicles, lifts or pulleys, connected bodies like trucks and trains.

When two moving bodies are connected by a string which is light and inextensible, there will be a tension in a string. By Newton's third law, the forces acting on the bodies will have the same magnitude but will act in opposite directions.

Learning Outcome

The learner should be able to use Newton's laws of motion to find the acceleration of connected bodies and the tension in the string(s).

Sub-Topic: Connected Particles

Competences	Content
The learner: • applies Newton's laws of motion to pulley systems. • works out problems involving smooth and rough surfaces for horizontal and inclined planes.	• Newton's laws of motion • Force exerted by the engine of a vehicle pulling another. • Pulley systems: - Connected bodies along a horizontal smooth surface - Connected bodies on inclined planes.

Teaching/Learning Strategies

- State Newton's laws of motion by brainstorming with the learners.
- With the aid of diagrams, guide the learners to illustrate all forces acting on connected bodies.
- Prepare and engage the learners with examples and exercises to apply the Newton's laws of motion to connected bodies on horizontal surfaces and inclined planes.

Guidance to the Teacher

- Connecting strings should be light and inelastic.
- Clearly drawn diagrams showing all the forces acting on the connected bodies should be emphasised.
- Pulleys should be smooth.
- Inclined planes can be smooth or rough.
- Moving wedges should be avoided.

SENIOR SIX TERM ONE

PURE MATHEMATICS

Topic 18: Integration

Duration: 18 Periods

Background

Integration is the process of obtaining an original function from a given gradient function; hence, it is the reverse of differentiation. Thus, if the rate of variation of a function is known, integration process can enable us to get the function itself. Integration is used to compute such things as the areas and volumes of irregular shapes and solids.

We call $\int f(x)\,dx$ an **indefinite integral** because it does not give a definite answer and we add an arbitrary constant after integrating.

The indefinite integral can be used to derive total cost and profit function from the marginal cost and marginal revenue functions.

We call $\int_a^b f(x)\,dx$ a **definite integral** because it gives a definite answer, where a is the **lower limit** of the integral and b is the **upper limit** of the integral.

The definite integral can be used in a number of applications in all science related disciplines such as calculating work done, business and economics, including price discrimination, revenue verses cost, consumer's surplus and producer's surplus.

Learning Outcome

The learner should be able to relate integration to differentiation and find the indefinite and definite integrals of simple functions.

Sub-Topic 1: Definite and Indefinite Integrals

Competences	Content
The learner: • relates the limit of summation to the integral sign. • determines indefinite integrals with the constant of integration. • evaluates definite integrals.	• The reverse of differentiation • Indefinite integrals • Definite integrals

Teaching/Learning Strategies

- Through exposition, guide the learners to relate integration to differentiation.
- Guide the learners to use the rule of integration.
- Help the learners to distinguish between indefinite and definite integrals.
- Guide the learners through examples, exercises and assignments to conceptualise the basics of integration.

Sub-Topic 2: Area under a Curve

Competences	Content
The learner: • sketches a curve. • uses integration to find the area between the given curve and the X-axis.	• Area under a curve

Teaching/Learning Strategies

- Through various exercises helps the learner to find the area under a curve

Guidance to the Teacher

- You should stick to the rule of integration: "Add One To The Power And Divide By The New Power."

- Emphasise the integration sign as a long S, and also indicate that the integration is with respect to a variable say x.
- Emphasise the constant of integration with indefinite integrals. We know that $y = x^3$, $y = x^3 + 5$, $y = x^3 - 6$, all satisfy $\frac{dy}{dx} = 3x^2$, for this reason we write $y = x^3 + c$ after integrating because we do not know whether the original function had a constant term or not.
- Remind the learners that when working with definite integrals, the constants of integration cancel and are excluded in the final result.
- Emphasises sketching the curves (degree 2) to clearly show the area covered.

Topic 19: Displacement, Velocity and Acceleration

Duration: 6 Periods

Background

In Integration, we looked at determination of indefinite and definite integrals. Under this topic, we are going to apply these integrals in determining:

i) the velocity given the acceleration

ii) displacement given the velocity

iii) finding integrals of trigonometric functions.

Displacement, velocity and acceleration

We also learned that displacement, velocity and acceleration are linked together by the process of differentiation with respect to time. In the reverse order, acceleration (a), velocity (v) and displacement(s), are linked together by integration. When we integrate an expression for the acceleration of a body with respect with time, we obtain an expression for the velocity of a body at a time, t i.e. $v = \int a\,dt$. Similarly, if we integrate an expression for the velocity of the body with respect to time, we obtain an expression for the displacement of the body at a time, t, i.e. $s = \int v\,dt$. We use the knowledge of indefinite integrals with boundary conditions to determine the expressions for the velocity and displacement.

Learning Outcome

The learner should be able to determine velocity and displacement of a body from an acceleration function.

Sub-Topic: Displacement, Velocity and Acceleration

Competences	Content
• The learner uses integration to find displacement and velocity.	• Velocity and acceleration

Teaching/Learning Strategies

- Involve the learners to link together the terms displacement, velocity and acceleration to the process of differentiation w.r.t. time i.e. $v = \frac{ds}{dt}$, $a = \frac{dv}{dt}$.
- Lead the learners to link together the terminologies a, v and s to the process of integration i.e. $s = \int v\,dt$, $v = \int a\,dt$

Guidance to the Teacher

- Let the learners explain the relationship between displacement, velocity and acceleration.
- Explain to the learners how differentiation and integration are used in this topic.
- Identify where the knowledge achieved in this topic is applied.

Topic 20: Series

Duration: 8 Periods

Background

A series is the sum of the terms of a sequence where a sequence is a set of numbers expressed in a definite order. The concept of series is utilised in banks and insurance companies. Series are classified into two i.e. the Arithmetic progression (A.P) and the Geometric progression (G.P).

An A.P is a sequence of numbers in which any term can be obtained from the previous one by adding a certain number called the *common difference, d*.

A G.P is a sequence of numbers in which any term can be obtained from the previous one by multiplying a certain number called the *common ratio, r*.

Learning Outcome

The learner should be able to distinguish between Arithmetic Progressions and Geometric progressions, generate both the A.P. and G.P. and find their sums.

Sub-Topic 1: Sequences

Competences	Content
The learner: • identifies the characteristics of a sequence. • identifies the characteristics of a series. • writes a series using the summation notation.	 • Sequences • Series • Series in summation notation

Teaching/Learning Strategies

- Discuss with the learners the special notation for representing sequences and series.

Sub-Topic 2: Arithmetic Progression

Competences	Content
The learner: • generates an Arithmetic progression (A.P). • determines the n^{th} term of an A.P by using the formula. • finds the sum of the first n terms of an A.P. • determines the value of n given the sum of an A.P and common difference d or last term l of an A.P.	• n^{th} term of an Arithmetic progression. • Sum of the first n^{th} terms of an Arithmetic progression.

Teaching/Learning Strategies

- Use the sum of a set of natural numbers and sum of squares of the natural numbers to guide the learners to express them using summation notation.
- Prepare different sets of numbers both positives and negatives to help the learners develop an A.P.
- Using the above sets, lead the learners to show how the formula for the nth term of an A.P, $U_n = a + (n-1)d$ is derived at.
- Derive the formulae, $S_n = \frac{n}{2}(2a + (n-1)\,d)$, $S_n = \frac{n}{2}(a + l)$ for finding the sum of the first n terms of an A.P and guide the learners to apply them to related questions.

Sub-Topic 3: Geometric Progression

Competences	Content
The learner: • identifies the characteristics of a geometric progression. • uses the characteristics to generate a	• Geometric progression • n^{th} term of a geometric progression

Competences	Content
geometric progression. • determines the nth term of a G.P by using the formula. • uses the formula to find the sum of the first n terms of a G.P. • finds the sum to infinity using the formula. • solves amount deposited in a bank using G.P.	• Sum of n terms of a geometric progression

Teaching/Learning Strategies

- Prepare different sets of numbers both positives and negatives to help the learners distinguish a G.P from an A.P.
- State the formula for the n^{th} term of a G.P $U_n = ar^{n-1}$ and guides the learners to apply it to related problems.
- Apply the formulae $S_n = \frac{a(r^n - 1)}{r - 1}$ when r >1 and $S_n = \frac{a(1 - r^n)}{1 - r}$ when r<1) for finding the sum of the first n terms of a G.P and guide the learners to apply them to related questions.
- Through exposition, guide the learners to derive and apply the formula for the sum to infinity $S_\infty = \frac{a}{1 - r}$.

Guidance to the Teacher

- Take the learners through this topic slowly so that they can internalise the competences to be developed.
- Let the learners identify situations where the knowledge achieved is applied.
- Use examples from both Science and Arts fields.

SECTION B

PROBABILITY AND STATISTICS

Topic 21: Random and Continuous Variables

Duration: 8 Periods

Background

Decision-making in many businesses, insurance companies, and other real-life situations is made possible by assigning probabilities to all possible outcomes to the situations and then evaluating the results. For example, a shopkeeper can compute the probability that he will make either 0, 1, 2, 3, 4, or more sales in a single day and will be able to compute the average number of sales he makes per day, per week, which will enable him to make better predictions over a period of time say, monthly.

When carrying out an experiment, *variables* are used to describe the event. A *variable* in this case can be defined as a characteristic that can assume different values. Letters of the alphabet such as X, Y, or Z can be used to represent variables. Since the variables are associated with probability, they are called *random variables*. Random variables may be either *discrete* or *continuous*. A *discrete random variable* is the variable that has values that can be counted. For example if a die is thrown, a letter such as X can be used to represent the possible outcomes, i.e. X is assigned values 1, 2, 3, 4, 5, or 6 corresponding to the outcomes. The relationship between the possible values of a random variable and the corresponding probabilities is term as the *probability distribution* of the random variable which may be specified in terms of a probability distribution function (p. d. f).

Learning Outcome

The learner should be able to identify the characteristics of a discrete or continuous random variable, compute its mean, variance and standard deviation.

Sub-Topic 1: Discrete Random Variables

Competences	Content
The learner: • identifies the: i) random variable. ii) discrete random variable. • identifies the properties of a p.d.f of a discrete random variable. • uses the properties of a p.d.f of a discrete random variable. • generates and constructs a probability distribution table. • calculates the expectation $E(x)$, Variance, $Var(x)$, and Standard deviation of a discrete random variable. • finds the mode and median of a discrete random variable.	• Concept of discrete random variable • Probability density function (p.d.f) of a discrete random variable • Properties of a p.d.f of a discrete random variable • Probability distribution table • Expectation $E(X)$, Variance, $Var(X)$, and Standard deviation of a discrete random variable • Mode, median

Teaching/Learning Strategies

- Use a die and ask the learners to list the possible outcomes.
- Relate the possible outcomes with a random variable.
- Define a discrete random variable.
- Through exposition, guide the learners to generate a probability distribution for throwing a die.
- Assign the learners to construct the probability distribution for a discrete random variable, "the number of heads obtained from tossing two coins.

- Engage the learners in tasks to find the sum of the probabilities of the distribution."
- Emphasise the two properties of the probability distribution of a discrete random variable.
- Lead the learners to represent the probability distribution in a columnar table.
- Involve the learners in calculating the expectation $E(X)$, variance, $Var(X)$, and standard deviation using the formulae.
- Help the learners to familiarise with the use of the table of distribution of probability while calculating the $E(X)$, $Var(X)$ and standard deviation using various exercises and assignments.

Sub-Topic 2: Continuous Random Variables

Competences	Content
The learner: • identifies the characteristics of a continuous random variable. • determines a p.d.f. of a continuous random variable. • applies properties of a continuous random variable. • finds the expectation, variance and standard deviation of a continuous random variable	• Concept of continuous random variable. • Continuous probability function • Properties of a Continuous random variable • Expectation, variance and standard deviation of a continuous random variable

Teaching/Learning Strategies

- Defines continuous random variable.
- Introduce to the learners the p.d.f of a continuous random variable as an area under the graph of the given function. i.e.

$$P(a \le X \le b) = \int_a^b f(x)\,dx$$

- Emphasise the two properties of the probability distribution of a continuous random variable.
- Involve the learners with various exercises and assignments in calculating the expectation $E(X)$, variance, $Var(X)$, and standard deviation using the formulae.

Guidance to the Teacher

- Help the learners to differentiate discrete and continuous random variables.
- Let the learners discuss and come up with situations where the competences in this topic can be applied.
- Take the students through this topic slowly.
- Give examples of benefits which students will get in this topic.

Topic 22: Binomial Distribution

Duration: 6 Periods

Background

There are some probability situations that may result into only two outcomes, or even be reduced to only two. Such situations may include:

i) when a baby is born, it may be either male or female

ii) in a final football match, a team either wins or loses.

Other situations that are reduced to only two possible outcomes may include:

i) a person taking a Pioneer bus may arrive either on time or not on time.

ii) a company producing items that are either defective or not defective

iii) a drug administered to a patient may be either effective or ineffectiveness.

All the above mentioned situations are called binomial or Bernoulli experiments. The outcomes of a binomial experiment are classified as *successes* or *failures.*

Therefore a ***binomial distribution*** is one that represents the outcomes of a binomial experiment and their corresponding probabilities.

Learning Outcome

The learner should be able to interpret a binomial distribution.

Sub-Topic: Binomial Distribution

Competences	Content
The learner: • identifies the characteristics of a binomial distribution. • applies properties of a binomial distribution.	• Concept of a binomial distribution • Properties of a binomial distribution

Competences	Content
• interprets the notation $B(n,\ p)$. • calculates the probability of event using formulae or tables. • finds the $E(x)$ and $Var(x)$ of binomial distribution	• Binomial notation • Binomial tables • Expectation, variance • Standard deviation

Teaching/Learning Strategies

- Introduce a binomial distribution as an example of a discrete random variable.
- Lead the learners into listing probability situations that may result into two outcomes of success or failure.
- Guide the learners through the properties of a binomial experiment.
- Define the binomial distribution and its notation.
- Help the learners to use the formula and the mathematical tables for binomial probabilities through various exercises and assignments.
- Involve the learners in calculating the expectation $E(x)$, variance, $Var(x)$, and standard deviation of a binomial distribution using the formula.

Guidance to the Teacher

- Let the learners understand the relationship of all parameters learnt in this topic.
- Give examples of situations in which this topic may be applied.
- Use examples which are drawn from both Arts and Science fields.

MECHANICS

Topic 23: Work, Power and Energy

Duration: 8 Periods

Background

The ***work done*** by a force is the product of the force and the distance moved in the direction of the force by its point of application. The SI unit of work is the joule (J).

The energy of a body is its ability for doing work. There are various forms of energy, however, for this course, we shall be confined to only forms of ***mechanical energy*** i.e. potential energy and kinetic energy. Potential energy is the energy a body possesses by virtue of its position. Kinetic energy is the energy possessed by a body by virtue of its motion.

The principle of conservation of mechanical energy states: "*If a particle is moving such that no external force other than gravity is doing work, then the total mechanical energy of the particle remains constant.*"

Power is the rate of doing work. The SI unit of power is the watt (W).

Learning Outcome

The learner should be able to find the work done, energy and power dissipated by a body.

Sub-Topic: Work, Energy and Power

Competences	Content
The learner: • defines work, energy and power. • works out problems involving work done against gravity, friction and by a constant force. • uses the principle of conservation of energy to solving problems. • relates work done to change in	• Work done against: - gravity by a constant force - friction • Principle of conservation of energy • Power

Competences	Content
energy. • solves power related problems.	

Teaching/Learning Strategies

- Discuss with the learners that once a mass of m kg is raised through a vertical distance, s, then work is done against gravity.
- Use a rough inclined plane to demonstrate how work is done both against gravity and frictional force.
- Through various exercises, lead the learners to calculate work done by a constant force, against gravity and friction.
- Explain that situations involving a moving body and there is no work done against friction and gravity is the only external force then the principle of conservation of energy is used.
- Ensure that the learners are exposed to various examples and exercises involving energy and power.
- Emphasise the use of SI units of work, energy and power every after a problem is worked

Guidance to the Teacher

- Do not make the impression that knowledge gained from this topic favours Science students only.
- Show the learners how the competences achieved from this topic are applied in their daily life.
- Use examples from both Science and Arts fields.
- Relate the concepts of work, energy and power.

SENIOR SIX TERM TWO

PURE MATHEMATICS

Topic 24: Matrices

Duration: 10 Periods

Background

A matrix is a rectangular array of numbers called elements or entries. Information can conveniently be presented as an array of rows and columns. The ***order*** of a matrix gives the format of how a matrix should be written. It is always in the form ***m x n*** where ***m*** is the number of rows and ***n*** is the number of columns in the matrix.

Learning Outcome

The learner should be able to carry out different operations on matrices of order 2 and order 3.

Sub-Topic: Matrices

Competences	Content
The learner: • states the order of a matrix. • carries out the operations on matrices. • calculates the determinant and inverse of a 2×2 matrix. • uses the inverse of a matrix to solve simultaneous equations. • uses the determinant method to solve simultaneous equations.	• Operations on matrices • Determinant of a 2×2 matrix • Inverse of a 2×2 matrix • Solution of simultaneous equations using matrices and determinant (Crammer's rule)

Teaching/Learning Strategies

- Lead the learners to formulate matrices of any order from real life situations.
- Involve learners in numerous exercises on addition, subtraction and multiplication of matrices.
- Emphasise to the learners about the commutative property $(AB \neq BA)$ in multiplication and compatibility of matrices through various exercises.
- Make revision on the determinant, inverse of a 2x2 matrix, and solving of simultaneous equations using matrices.
- Prepare various exercises on solving simultaneous equations using the determinant.

Guidance to the Teacher

- Let the learners identify situations where the competences developed can be applied.
- Let all learners know the purpose of learning matrices.
- Guide (especially the Arts) students to solve simultaneous equations using matrix method.

Topic 25: Normal Distribution

Duration: 8 Periods

Background

The normal distribution is a continuous, symmetric, bell-shaped distribution of a variable. It is the most important continuous probability distribution for both practical and theoretical statistics. The normal distribution provides a good probability model for many continuous variables whose values depend on the effect of a number of factors. Such variables may include the heights of people or objects and other measurements of biological importance, life time of batteries, electric bulbs, etc., weights of farm produce supplied, metal bars manufactured in a factory and packed in boxes, etc.

Learning Outcome

The learner should be able to identify the properties of a normal distribution and find probabilities for a normally distributed variable.

Sub-Topic: Normal Distribution

Competences	Content
The learner: • interprets the notation $N(\mu,\ \delta^2)$ of normal distribution. • identifies the properties of the normal distribution. • finds the area under the standard normal curve given various z values • writes the given problem in probability notation e.g. $P(X \leq 20)$ • standardises the random variable into the standard normal variable Z. • reads and uses the standard normal tables to find probabilities.	• Concept of normal distribution • Properties of normal distribution • Standardisation • Standard normal tables

Teaching/Learning Strategies

- Introduce a normal distribution as a continuous random variable.
- Guide the learners to outline the properties of the normal distribution.
- Help the learners to i) sketch the normal curve ii) shade the desired area iii) look up the z value in the table to get the area.
- Through various exercises, bring out the following, finding the area under the normal curve (required probability):

  i) between 0 and any z value.

  ii) from the z value to the end of the tail.

  iii) between two z values on the same side of the mean.

  iv) between two z values on opposite sides of the mean.

  v) Less than any z value to the right of the mean.

  vi) Greater than any z value to the left of the mean.

- Lead the learners to use the formula for a standard score to transform the normally distributed variable into the standard normal variable.
- Help the learners to use the mathematical tables for cumulative normal distribution through various exercises and assignments.
- Assign the learners in groups to determine the probabilities for a normally distributed variable by transforming it into a standard normal variable.

Guidance to the Teacher

- Take the learners through this topic so that they can understand the notation used.
- Give examples in which the competences developed in these topics are applied.
- Relate the concept of finding area under the curve using integration approach and finding the area under the standard normal curve in this topic.

SENIOR SIX TERM THREE

PURE MATHEMATICS

Topic 26: Differential Equations

Duration: 8 Periods

Background

We learnt that the derivative is also an instantaneous rate of change i.e. we denoted the instantaneous rate of change of y with respect to time t as $\frac{dy}{dx}$.

For many growth processes, the rate of change of the amount of a substance with respect to time is proportional to the amount present. This can be represented by the equation $\frac{dy}{dt} = ky$ where k is a constant.

An equation of this type, where y is an unknown function of say x, is called a **differential equation** because it contains derivatives or differential coefficients.

There are several methods of solving differential equations. However, in our case, we are only going to use the method of separation of variables to solve these equations.

Differential equations are used to solve applied problems such as those involving carbon dating and radioactive decay; the amount of drug in an organ; mixtures; supply and demand; logistic growth and marginal productivity.

Learning Outcome

The learner should be able to use integration to find the general solution of a differential equation, and find particular solutions of differential equations in initial value problems.

Sub-Topic: Differential Equations

Competences	Content
The Learner :	
• identifies a differential equation.	• Concept of a differential equation
• states the order of a differential equation.	• Order of a differential equation
• finds the general solution and particular solution of a differential equation.	• General solution and particular solution of a differential equation
• solves problems involving separable differential equations.	• First order differential equations with separable variables
• solves problems involving separable differential equations related to natural occurrences.	• Formation of differential equations of natural occurrences

Teaching/Learning Strategies

- Introduce the topic using equations such as $y = x^2$ and involve them to find the first derivative.
- Relate the above derivatives to the definition of a differential equation.
- Define the order of a differential equation and prepares work for the learners to identify the different orders.
- Engage the learners in several tasks to use integration to determine the general and particular solution of first order differential equations.
- Prepare differential equations with separable variables and guides the learners to separate and integrate them.
- Provide word problems with separable variables for the learners to form and solve the differential equations.

Guidance to the Teacher

- Let the learners identify where the competences achieved/developed are applied in life subjects.
- Show the relevancy of this topic to their subject combination or their courses to be done after A level.

Appendix: Derivatives and Integrals of Trigonometric Functions

Trigonometric Function	Derivative	Integral
$y = \sin x$	$\frac{dy}{dx} = \cos x$	$\int \sin x \, dx = -\cos x + c$
$y = \cos x$	$\frac{dy}{dx} = -\sin x$	$\int \cos x \, dx = \sin x + c$
$y = \sin ax$	$\frac{dy}{dx} = a\cos ax$	$\int \sin ax \, dx = -\frac{1}{a}\cos ax + c$
$y = \cos bx$	$\frac{dy}{dx} = -b\sin bx$	$\int \cos bx \, dx = \frac{1}{b}\sin bx + c$
$y = \sin ax + b$	$\frac{dy}{dx} = a\cos ax$	
$y = \sin(bx + t)$	$\frac{dy}{dx} = b\cos(bx + t)$	

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Uganda Advanced Certificate of Education

Subsidiary Information and Communication Technology

TEACHING SYLLABUS

Acronyms

ALU – Arithmetic Logic Unit
ASCII –American Standard Code for Information Interchange
BIOS – Basic Input Output System
bps – Bits per Second
Bps – Bytes per Second
CAD/M – Computer Aided Design/ Manufacturing
CAL – Computer Aided Learning
CAT 5 – 'Category 5' cable
CD – Compact Disc
CD-R – Compact Disc Recordable
CD-ROM – Compact Disc Read Only Memory
CD-RW – Compact Disc Re-Writable
CPU – Central Processing Unit
CRT – Cathode Ray Tube
DBMS – Data Base Management System
DDR – Double Data Rate
DFD – Data Flow Diagrams
DOS – Disc Operating System
DSL – Digital Subscriber Line
DTP – Desktop publishing
DVD – Digital Versatile Disc
EFT – Electronic Funds Transfer
EULA – End User Licence Agreement
FAQ – Frequently Asked Questions
FIFO - First in First Out
FNF – First Normal Form
FTP – File Transfer Protocol
Gb – Gigabyte
GIF – Graphic Interchange Format
GIGO – Garbage In Garbage Out
GPS – Global Positioning System
GUI – Graphical User Interface
GUI – Graphical User Interface
GW – Gateway
HCI – Human Computer Interaction
HTML – Hyper Text Mark-up Language
HTTP – Hyper Text Transfer Protocol
IC – Integrated Circuit
ICT – Information and Communication Technology
IP – Internet Protocol
IRC – Internet Relay Chat
ISDN – Integrated Services Digital Network
ISP – Internet Service Provider
JPEG – Joint Photographic Experts Group
Kb – Kilobyte
KH – KiloHertz
LAN – Local area network
LCD – Liquid Crystal Display
LED – Light Emitting Diode
LIFO – Last in First Out
MAN – Metropolitan Area Network
MICR – Magnetic Ink Character Recognition
MP3 – MPEG Layer 3
NIC – Network Interface Card
NOS – Network Operating System
OCR – Optical Character Recognition
OMR – Optical Mark Recognition
OMR – Optical Mark Reader
OOPL – Object Oriented Programming Language
OSI – Open Systems Interconnection
PCI – Peripheral Component Interconnect
PDA – Personal Data Assistant

POS – Point of Sale
PPM – Pages per Minute
RAM – Random Accesses Memory
ROM – Read Only Memory.
SCSI – Small Computer Systems Interface
SQL – Structured Query Language
TCP – Transmission Control Protocol
TFTP – Trivial File Transfer Protocol
TNF – Third Normal Form
URL – Uniform Resource Locator
USB – Universal Serial Bus
VGA – Video Graphics Array
WAN – Wide Area Network
WAP – Wireless Application Protocol

CONTENTS

Introduction

This syllabus was developed after looking at the need for Information and Communication Technology (ICT) knowledge and skills among learners and how these help to improve on the teaching-learning process. The education sector and the world of work require an individual to possess ICT knowledge and skills. This is evidenced by the demand for computer literacy and computer skills for the respective job vacancies being advertised today.

This syllabus has been prepared to help the learner acquire ICT knowledge and skills required to meet the challenges of ICT applications in society. The syllabus emphasises use of practical examples whenever possible to teach ICT applications which the world of work expects a high school graduate to possess.

The Subsidiary ICT syllabus is meant to help the learner acquire skills required by end users of ICTs and which can be applied in a variety of fields.

Purpose of the Teaching Syllabus

This Subsidiary ICT Teaching Syllabus is meant to guide teachers handling Subsidiary ICT at A level. It is designed to achieve the aims of teaching Subsidiary ICT, standardise the teaching of the subject, guide the teachers of Subsidiary ICT and produce students with more skills in ICT who can effectively compete on the global market.

This Teaching Syllabus will help the teacher to cover the syllabus content adequately up to appropriate depth at each level of study. The design of this syllabus emphasises the teaching approaches to be used for each sub-topic. The number of periods allocated should also guide teachers to effectively plan to complete the syllabus within the recommended time.

Broad Aims of Education in Uganda

1. To promote understanding and appreciation of the value of national unity, patriotism and cultural heritage, with due consideration of internal relations and beneficial inter-dependence.
2. To inculcate moral, ethical and spiritual values in the individual and to develop self-discipline, integrity, tolerance and human fellowship.
3. To inculcate a sense of service, duty and leadership for participation in civic, social and national affairs through group activities in educational institutions and the community.

4. To promote scientific, technical and cultural knowledge, skills and attitudes needed to promote development.
5. To eradicate illiteracy and to equip the individual with basic skills and knowledge to exploit the environment for self-development as well as national development, for better health, nutrition and family life, and the capacity for continued learning.
6. To contribute to the building of an integrated, self-sustaining and independent national economy.

Aims and Objectives of Secondary Education in Uganda

1. Instilling and promoting national unity, and an understanding of social and civic responsibilities; strong love and care for others, and respect for public property as well as an appreciation of international relations and beneficial international co-operation.
2. Promoting an appreciation and understanding of the cultural heritage of Uganda including its languages.
3. Imparting and promoting a sense of self-discipline, ethical and spiritual values, personal responsibility and initiative.
4. Enabling individuals to acquire and develop knowledge and an understanding of emerging needs of society and the economy.
5. Providing up-to-date and comprehensive knowledge in theoretical and practical aspects of innovative production, modern management methods in the field of commerce and industry and their application in the context of social economic development of Uganda.
6. Enabling individuals to develop basic scientific, technological, agricultural, and commercial skills required for self-development.
7. Enabling individuals to develop personal skills of problem-solving, information-gathering and interpretation, independent reading and writing, self-improvement through learning and development of social, physical and leadership skills such as are obtained through games, sports, societies and clubs.
8. Laying the foundation for further education.
9. Enabling the individual to apply acquired skills in solving problems of the community.
10. Instilling positive attitudes towards productive work and strong respect for the dignity of labour and those who engage in productive labour activities.

Aims of Teaching Subsidiary ICT

Teaching Subsidiary ICT is aimed at:

1. helping the learner develop and consolidate his/her knowledge of ICT and be aware of new and emerging technologies.

2. encouraging the learner to develop as an independent user.
3. encouraging the learner to develop ICT skills to enhance their work in a variety of subject areas.
4. equipping the learner with skills for lifelong learning.

The ICT skills in the syllabus are directly applicable to the study of other subjects and schools are encouraged to provide opportunities for their learners to apply these skills to a range of learning areas (subjects).

Factors Considered while Developing the Subsidiary ICT Syllabus

The following factors were considered while developing this syllabus:

- the low levels of ICT literacy in the country
- the high demand for ICT skills as a major requirement for employment
- the unequal access to basic ICT training
- the need to reduce the digital divide.

Target

The Subsidiary ICT syllabus is intended for the Subsidiary ICT Advanced Level secondary school teacher. The learner can also use the syllabus as guidance for further learning and personal development of skills emphasised therein.

Scope and Depth

The syllabus covers content for Senior Five and Senior Six. It addresses skills in Word processing, electronic spreadsheets, electronic presentation, electronic publication and Databases. It also covers the knowledge areas like computer hardware and software, data communication, system security, ICT ethical issues and emerging technologies.

Teaching Sequence

The teaching sequence should follow the order in which the topics have been arranged in this teaching syllabus.

Senior Five Term One

Topic	Sub topic
Introduction to Computing	• Introduction to Computers
	• World of ICTs
	• Implications of Using ICTs (Advantages and Disadvantages)
Computer Management	• Booting Process

	• File Management
	• Common Utilities
	• Print Management
Computer Laboratory Care and Maintenance	• Computer Literacy
	• Secure Laboratory Environment
	• Servicing and Maintenance
Computer Word Processing I	• Introduction to Word Processing
	• Working with Word Processing Software

Senior Five Term Two

Computer Hardware	• Input Devices
	• Output Devices
	• Storage Devices
	• Processor Components
Computer Software	• System Software
	• Application Software
Electronic Spreadsheets I	• Introduction to Spreadsheets
	• Working with Spreadsheets
	• Managing Spreadsheets
	• Formulas and Functions
Internet and World Wide Web	• Introduction to the Internet
	• Internet Services
	• World Wide Web

Senior Five Term Three

Computer Word Processing II	• Page Layout
	• Date Tabulation
	• Use of Objects
	• Document Accuracy
	• Mail Merge, Document Referencing and Printing
Electronic Presentation	• Introduction to Electronic Presentation
	• Working with Presentation Software
	• Developing a Presentation

	• Charts
	• Graphical Objects
	• Presentation Output
	• Slide Show

Senior Six Term One

Data Communication and Networking	• Introduction to Data Communication
	• Introduction to Computer Networks
Electronic Publication	• Introduction to Electronic Publishing
	• Publishing Basics
	• Document Layout
	• Document Enhancement
	• Outputs
	• Complete Publication
	• Web Publishing

Senior Six Term Two

Electronic Spreadsheets II	• Working with Charts
	• Worksheet Page Layout
	• Printing a Worksheet
Databases	• Introduction to Databases
	• Database Objects

Senior Six Term Three

System Security, ICT Ethical Issues and Emerging Technologies	• Computer System Security
	• Privacy and ICT Ethical Issues
	• Emerging Technologies
	• ICT industry

Time Allocation

The subject should be given six periods per week on the school's teaching timetable. This is to allow enough time for the learners to engage in practical activities for developing hands-on skills and get exposed to real

life computing experiences. The teacher is advised to give the learners as many practical sessions as time can allow to enable them develop the computing skills that this syllabus stipulates. As much as possible, the learner should be allowed to explore the ICTs exposed to him/her for the benefit of developing new skills and knowledge.

How to Use the Syllabus

This Subsidiary ICT syllabus is engineered towards developing practical skills amongst the learners. Use of experimentation and practical sessions is highly encouraged. Student research, especially with use of the Internet, is highly encouraged.

The syllabus has suggested teaching-learning approaches though they are not final. You can come up with other teaching strategies to enable you cover the content described in this syllabus. While deciding on other strategies, you should consider the following:

- Content to be covered and skills therein
- Number of learners in the class
- Learning outcomes and the competences to be developed
- Individual needs of the learners
- Time available

You are not restricted to a specific operating system and its applications. You are encouraged to use any platform as long as it can enable you to achieve the stated competences. For examination purposes, you are encouraged to state the operating system and application used for proper assessment.

Syllabus Features

The Subsidiary ICT syllabus will empower learners with knowledge and skills to solve the day-to-day problems in the society using ICTs. This teaching syllabus has the following features which should be noted by the teacher.

Duration

This gives the number of periods proposed for each topic. These are only to be used as a guide to enable the teacher cover the work adequately.

Learning Outcome

This is a statement that specifies what the learner should have known or be able to do upon successful completion of the topic.

Competences

These define a specific range of skills, knowledge, or ability the learner should have attained by the end of each topic. The teacher should use the competences to plan the teaching/learning strategies suitable for the lesson. Competences also guide in evaluation at the end of the learning process.

Guidance to the Teacher

This is to guide you prepare for lessons in a given topic. It spells out the areas of emphasis and tools to be used in a given topic.

Teaching /Learning Strategies

These provide the teacher with guidance on the proposed activities and strategies that can be used in the teaching. The following are the suggested teaching /learning strategies;

1. *Hands on activities (Practical Sessions):* The learners work in pairs or individually to develop skills or put into practice the acquired knowledge. You will need to carefully plan a range of activities that clearly identify the purpose of the practical session. Where learners work in groups, every learner should have an opportunity to take part in the hands-on activity.
2. *Teacher guided research:* An instructional technique where you give students areas of research and as a result, the learner finds out more information in the given areas.
3. *Group discussion and peer presentation:* A technique where the students are divided into small manageable groups to share knowledge/ findings. Each group should be given an opportunity to present their findings to the rest of the class under your guidance.
4. *Brainstorming:* A technique used to gather ideas about a topic or learning area spontaneously contributed by the learners.
5. *Device identification:* An approach that requires the learner to identify and distinguish between devices.

6. *Teacher exposition:* An instructional technique where you put the topic into context for the learner to elicit his/her contributions. This approach is most appropriate when introducing a new topic.
7. *Use of simulations:* The use of computer systems (programmes) to imitate the operation of a real-world process or system.
8. *Collaborative tasks:* An approach that requires the learner to work with online groups in planning, collecting the request data and solving problems. For example discussion groups and forums.

As a teacher, you are not restricted to the suggested teaching / learning strategies. You can develop your own strategies that suit your environment and the desired learning outcome.

Mode of Assessment

The assessment in this syllabus is software independent. Any hardware platform, operating system and application packages can be used for the examination, provided they have the capabilities to enable the learner fully demonstrate all the acquired skills, and meet the assessment objectives of this syllabus.

The application software needed for this syllabus are Word processors, spreadsheets, electronic presentation, Database applications, Web browsers, and electronic publishing. Use of other operating systems other than Windows is highly encouraged.

The assessment of Subsidiary ICT at Advanced Level will be done in two ways, that is, continuous assessment and summative assessment.

Continuous Assessment

This shall be carried out by the subject teacher within the provided teaching time. It can be done in form of practical sessions, tests, class activities, oral questions, open quizzes and assignments. It is advised that assessment for knowledge objectives be done at the end of each topic.

Practical skills can be assessed by giving a series of practical sessions relevant to the topics covered to develop the learners' hands-on skills.

Summative Assessment

This shall be done at the end of the two years of Advanced Level Education.

Two papers will be used to assess the subject as follows:

Subsidiary ICT Paper One: (2 ½ hours)

This paper will be based on basic ICT concepts and their application areas. The paper will cover the entire syllabus with emphasis on application of ICT knowledge in a variety of fields (Social, Economic, Political, Environmental, Informational).

This will be a written paper made up of 20 equally weighted compulsory questions. The duration of the examination paper will be **2 Hours 30 Minutes.**

The questions shall be structured and semi-structured requiring a short response, a phrase or one or two sentences. Some of the semi-structured questions will require extended responses of about three sentences.

All questions are to be answered in the spaces provided on the examination paper**.**

This paper will be set basing on the table of specifications below.

Table of Specifications

Topic	Know.	Comp.	Appl.	Analy.	Total
Introduction to Computers	1		1		2
Lab Care, Troubleshooting and Maintenance			1		1
File management		1	1		2
Computer Hardware	1	1		1	3
Computer Software	1	1	1		3
Internet and World Wide Web		1	2		3
Data	1	1			2

Communication and Networking,					
Trends in Computing	1			1	2
Applications			2		2
Total	**5**	**5**	**8**	**2**	**20**
Percentage	**25%**	**25%**	**40%**	**10%**	**100%**

Subsidiary ICT Paper Two (3 Hours)

This will be a practical paper with five compulsory equally weighted questions each carrying 20 marks. The duration of the paper shall be **3 hours.**

The questions will be drawn from the topics of word processing, electronic spreadsheet, electronic presentation, electronic publication and databases. The paper will emphasise application of ICT skills in the topics mentioned. Where applicable, support files will be provided to supplement the set questions.

This paper will be based on the table of specifications below.

Table of Specifications

Content Area	**Know.**	**Comp.**	**Appl.**	**Analy.**	**Total**
Topic 3 (Word processing)	20%	30%	35%	15%	100%
Topic 6 (electronic Spreadsheets)	20%	30%	35%	15%	100%
Topic 8 (electronic Presentation)	20%	30%	35%	15%	100%
Topic 10 (Databases)	20%	30%	35%	15%	100%
Topic 11 (electronic Publication)	20%	30%	35%	15%	100%

Assessment Weighting

Paper one (theory paper) 40%

Paper two (Practical paper) 60%

General Guidance to the Teacher

The guidance provided in this section cuts across all topics in this syllabus.

- The teacher should define and analyse the specific tasks and skills to be learned, frequently assess student performance, and provide systematic feedback to the learner.
- Tailor the strategies and methods of instruction to provide for specific learners behaviours and learning disorders, mental retardation, physical disabilities, vision impairments, and hearing problems.
- The teacher is advised to move around the classroom and see what the students are doing.
- The teacher should encourage and practise the habit of previewing every document before printing.
- The teacher should make use of cyber or digital content to enhance learning.
- The teacher should employ the problem base learning strategy.

Topic 1: Introduction to Computing

Duration: 12 Periods

Background

The topic introduces the learner to computers, their use and implications of using them in a variety of fields. It is developed bearing in mind that most of the learners might be encountering the subject for the first time. They need to attain the background knowledge to the use of computer systems across a number of fields. The topic lays a foundation to the rest of the topics. It should be well handled to give the learners a solid foundation in the subject.

Learning Outcome

The learner should be able to describe the application of Information and Communication Technologies (ICTs) in society.

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
1. Introduction to Computers	The learner: • describes a computer. • identifies different parts of a computer and their uses. • makes a distinction between information and data. • describes the information processing cycle.	• Describing computers • Parts of a computer • Data and information • Information processing cycle	• Hands-on activities on identifying parts of a computer or device identification • Teacher guided research and peer presentations on information, data and the processing cycle

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Sub-Topic	Competences	Content	Teaching/ Learning Strategies
2. World of ICTs	The learner: • explains the meaning of ICTs. • justifies the use of ICTs in society.	• Use of ICTs in: - business - education - health - security - politics and governance - art, leisure and entertainment - industrial, technical and scientific uses • Searching the Internet.	• Teacher exposition on the concept of ICTs • Brainstorming the different areas where computers are used • Teacher guided research and group presentations on use of ICTs in society • Use of simulations on the use of computers in a variety of fields • Use of internet facility to research on this topic
3. Implications of Using ICTs	The learner: • discusses the implications of using ICTs.	• Implications of ICTs: - social / ethical - economic - political - environmental (Green Computing) - security, reliability and resilience of computer systems	• Teacher exposition on the implications of ICTs on any of the areas • Learners brainstorm other implication of using ICTs • Teacher guided research on implications of using ICTs • Peer/group

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
			presentation on the implication of using ICTs

Guidance to the Teacher

- You are advised to introduce the topic using real parts of a computer where possible. In the event that such objects cannot be obtained, use their images which are readily available online.
- The implications of using ICTs should clearly look at the advantages and disadvantages of using ICTs in each of the areas that have been highlighted in the table above.
- Use of ICTs in business should focus on banking, mobile money transfers and Electronic Funds Transfer (EFT).
- You are encouraged to organise learners in groups to make presentations on the implications of ICT in society.

Suggested Competences for Assessment

- Assess the learners' ability to distinguish the different parts of a computer and other ICT devices and their uses.
- Discuss the implication of using ICT in a variety of fields.

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Topic 2: Computer Management

Duration: 16 Periods

Background

Interacting with computers and other ICTs for the first time is one of the most challenging tasks. However, system developers invented storage media, system administrative tools, services and programmes, menus, graphics, commands and most interestingly voice recognition interfaces to facilitate the interaction and dialog between the system and the user.

It is important that the learner is introduced to the general operating system environment, common files and folders plus their management, and basic utilities.

Learning Outcome

The learner should be able to demonstrate that he can efficiently manage files.

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
1. Booting Process	The learner: • describes the booting process. • identifies types of booting. • explains the concept of a computer programme. • explains various ways of starting a programme.	• Booting of a computer • Computer programme	• Demonstrating the booting processes • Discussing the concept of a computer programme
2. File Management	The learner: • defines a folder. • creates a folder on a storage medium of a computer. • moves a folder to a desired location.	• Folders	• Demonstrating the creation and management of a file and a folder • Discussing the types of files • Demonstrating how to

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
	• deletes a folder. • defines a file. • creates a file. • identifies file types. • saves a file in a desired location. • uses folders and sub folders to effectively categorise files. • describe how to customise the Desktop. • explains the major icons on the desktop.	• Files • Desktop	customise a Desktop
3. Common Utilities	The learner: • defines a utility programme. • lists utility programmes (search utility, file compression utility, disk defragmenter, antivirus). • uses search tools to locate files or folders. • compresses and decompresses a folder. • defragments a storage medium. • defines an anti-virus programme.	• Utility programs	• Describing the concept a utility programme • Demonstrating the use of the search utility • Demonstrating the use of the file compression utility • Demonstrating the use of the disk defragmenter • Demonstrating the use of an anti-virus programme

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
	• identifies anti-virus programmes. • uses anti-virus programmes.		
4. Print Management	The learner: • selects a printer. • prints a document.	• Printing	• Demonstrating the concept of print management

Guidance to the Teacher

- Demonstrate to the learners and allow them time to individually practise how to boot a computer and safely shut it down, customise a desktop, adjust settings to user preferences as well as create and delete directories using the GUI.
- Use of Ms DOS is not expected in this topic.

Suggested Competences for Assessment

- Assess the learners' ability to customise the user desktop, create, delete a directory; locate a file or folder in a given directory.

Topic 3: Computer Laboratory Care and Maintenance

Duration: 16 Periods

Background

The use of ICTs has a number of challenges for example, computers malfunction, laptops break down, servers go offline, networks become unavailable and computers slowdown with time, etc. All of these problems can be minimised by keeping up with regularly scheduled preventive maintenance activities.

It is important for every user to have an idea on basic preventive maintenance in order to maintain the equipment in a good running condition. This topic will equip the learner with skills to maintain his/her computer systems in a good running condition and the safety measures to observe when working in a computer laboratory.

Learning Outcomes

The learner should be able to:

- take care of computer systems.
- maintain (service) computer systems.
- troubleshoot malfunctioning computer systems and restore them to a good running condition.

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
1. Computer Literacy	The learner: • describes the booting process of a computer system. • explains the meaning of computer literacy. • starts computer systems. • opens application programs.	• The booting process • Meaning of computer literacy • System start up • Locating and opening applications	• Brainstorming the protective measures in the laboratory • Hands-on activities on starting computer systems and programs • Teacher guided research and

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Sub-Topic	Competences	Content	Teaching/ Learning Strategies
			presentations on booting process
2. Secure Laboratory Environment	The learner: • identifies areas of laboratory security. • adheres to safe use of the computer laboratory. • prepares laboratory rules and regulations.	• Areas of laboratory security: - physical security - electric power security - security cameras - first aid boxes - fire extinguisher - air conditioning • Safe use of the laboratory • Laboratory rules and regulations	• Teacher exposition on security of a laboratory • Brainstorming the areas of lab security • Teacher guided research on areas of lab security • Device identification of some equipment involved in lab security
3. Servicing and Maintenance of Computer Systems	The learner: • explains the importance of servicing and maintaining a computer. • installs system and application software. • uninstalls software. • carries out troubleshooting on computers	• Importance of servicing and maintaining a computer • Cleaning of computers • Updating of software • Upgrading software • Software installation • Fine-tuning the	• Brainstorming the importance of servicing and maintenance of a computer • Teacher demonstration on installation of system and application software • Hands-on activity on

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
	(start-up errors, hanging applications and warm booting).	system	installation and fine tuning of computer systems • Brainstorming during installation process • Identification of executable files

Guidance to the Teacher

- Provide some few computers where the learner can practise how to install and uninstall software on computer systems. This should be done for both application software and system software.
- Guide the learner to identify and correct simple practical problems encountered when using a computer. For example, simple troubleshooting software failures, boot failure, identifying loose power connection and many more.
- Where the word lab or laboratory has been used, it is exclusively referring to the computer laboratory.

Suggested Competences for Assessment

- Assess the learners' ability to install application and system software; take care of a computer system and use it safely.

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Topic 4: Computer Word Processing

Duration: 12 Periods

Background

Computer word processing encompasses production of professional looking documents like letters, memos and circulars. In a typical office where many documents are typeset, formatting and editing of such documents becomes a nightmare where manual modes of document production, filing and transmission are used.

In order to minimise and eliminate such hassles, several electronic devices and services by computerised systems and electronic typewriters have been developed for more efficiency and effectiveness in document production.

Computerised word processing systems have got easy to use document edit and format features capable of making documents look more and more business like if well mastered. Some people and organisations earn their living by producing documents for others using computerised systems.

Therefore, it is important that our learners are introduced to the basic practical knowledge and skills of word processing in order to be able to produce, and communicate documents better.

Learning Outcome

The learners should be able to demonstrate basic knowledge and skills in document production.

Sub-Topic	Competences	Content	Learning/ Teaching Strategies
1. Introduction to Word Processing	The learner: • defines the concept of word processing. • describes various examples of Word processors (MS Word, AbiWord, openoffice.org writer, La Tex editor and LyX). • opens a word	• Word processing	• Demonstrating the concept of word processing • Discussing the concept of word processing. • Demonstrating the opening of a word processor

Sub-Topic	Competences	Content	Learning/ Teaching Strategies
	processor. • identifies basic features of a word processor.		and related features
2. Working with Word Processing Software	The learner: • creates a new document . • identifies different word document templates. • shows knowledge of using inbuilt word document templates. • uses inbuilt word document templates. • names and saves a file in a given location. • identifies features of word processor interface. • typesets content in a new document.. • shows basic skills of using word processor edit features. • formats a document • imports text and clips and other images from digital sources, files or websites. • manipulates imported text, and images by resizing, cropping and maintaining aspect ratio.	• New document • Word processor interface features • Document typesetting • Document editing • Document formatting • External data	• Demonstrating the creation of a word document • Demonstrating the opening and closing of a word document • Demonstrating the formatting of word processing • Demonstrating the importation of external data into a word processor

Senior Five Term I

Guidance to the Teacher

- Although you are at liberty to decide on the word processor to use, make sure it has all the features required by this syllabus.
- Provide time for your learners to practise and develop skills in printing a variety of styles.
- Word processed documents involving equations should be considered to allow use of the equation editor.
- Proofreading a document includes consistent line spacing, consistent character spacing, re-pagination, removing blank pages, removing widows/ orphan tables and lists split over columns or pages.

Suggested Competences for Assessment

- Assess the learners' ability to identify, open and close a Word processing software on computer systems.
- Choose appropriate word processing software basing on the features for a given task.

Topic 5: Computer Hardware

Duration: 16 Periods

Background

A computer is made up of hardware and software. An analogy can be made to humans that the hardware is your body and the software is your mind. It is important to recognise that the way humanity is comprised of both the physical and mental, a computer is nothing without both hardware and software.

Hardware is any physical part of the computer that you can touch, see and pick up. Webster's dictionary defines hardware as 'major items of equipment or their components used for a particular purpose'. Some examples of hardware include the monitor, keyboard, mouse, disk drives, printer, scanner and speakers.

Learning Outcome

The learner should be able to use and describe the functions of common hardware devices.

Sub-Topic	Competences	Content	Teaching/Learning Strategies
1. Input Devices	The learner: • identifies the basic input devices. • distinguishes between input devices by their characteristics and functionality .	• Input devices such as digital cameras, barcode readers, keyboards, mouse, microphones, scanners, touchpad and joysticks • Characteristics and functionality of input devices.	• Brainstorming and identifying/naming available input devices • Hands-on activities on how to use various input devices and determine their characteristics • Teacher guided research on the characteristics and functionalities of input devices

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Sub-Topic	Competences	Content	Teaching/Learning Strategies
2. Output Devices	The learner: • identifies different output devices. • distinguishes between output devices by their characteristics and functionality. • identifies the different peripheral device interfaces.	• Output devices such as visual display units, printers, analog devices for speech generation and speakers • peripheral device interfaces - Universal Serial Bus (USB) - serial - parallel	• Brainstorming and identifying/naming available output devices • Hands-on activities on how to use various output devices, and determining their characteristics • Teacher guided research on the characteristics and functionalities of output devices
3. Storage Devices	The learner: • categorises secondary storage devices. • uses secondary storage devices. • explains the characteristics of storage devices.	• Types of secondary storage devices - magnetic - solid state and - optical devices • Characteristics of storage devices: - storage capacity (speed, bits, bytes...) - transfer	• Brainstorming and identifying/naming available secondary storage devices • Hands-on activities, on how to use storage devices • Teacher guided research on the characteristics and functionalities of the storage devices

Sub-Topic	Competences	Content	Teaching/Learning Strategies
	• identifies the primary storage devices.	rate - access time - methods of access • Primary storage devices: - memory chips	• Teacher exposition, on the primary storage, its use and devices used for primary storage
4. Processor Components	The learner: • appreciates the parts of the Central Processing Unit (CPU) and their functions. • describes the types of processors in computers and other electronic devices.	• Control unit • Arithmetic Logic Unit (ALU) • Registers • Processors	• Teacher exposition, on the parts of the CPU and their functions • Teacher guided research on the types of processors

Guidance to the Teacher

- You need to have the necessary hardware components that are relevant to the topic so that the learner can see and use them. Where the hardware is not available, appropriate images can be used. Use of real objects should take the first priority.

Topic 6: Computer Software

Duration: 08 Periods

Background

As mentioned in Topic 5 (Computer Hardware), computer software is compared to your mind. Each and everything that happens inside the computer is controlled by some form of software: from the high level word processors, games and other applications, to the low-level device drivers that tell your hardware exactly what it has to do to make them work properly.

Software is a collection of computer programmes and related data that provides instructions to computer hardware. It is these instructions which tell the hardware that it needs to print a document or save a file or display a webpage, etc.

Learning Outcome

The learner should be able to describe the major categories of software and their functions.

Sub-Topic	Competences	Content	Teaching/Learning Strategies
1. System Software	The learner: • identifies different types of system software. • describes the functions of operating systems.	• Types of software e.g. operating systems, utilities and programming languages • Functions of operating systems	• Brainstorming the system software • Teacher exposition on the types and functions of software • Teacher guided research and peer presentations on other system software
2. Application Software	The learner: • identifies different types of application	• Types of application software	• Brainstorming application software

Sub-Topic	Competences	Content	Teaching/Learning Strategies
	software. • explains the uses of different application software.	• Uses of application software	• Teacher exposition on the types and function of application software • Teacher guided research and peer presentations on other application software

Guidance to the Teacher

- There is need to have a variety of application and systems programmes for practice. You are advised to create an activity that introduces the learner to the distinction between system software and application software.
- Application software is designed to help the user to perform specific tasks while system software is responsible for managing and controlling computer hardware.
- Using a variety of files with different file types, create an activity that requires a learner to determine the appropriate application software to use for each of the files.

Suggested Competences for Assessment

Assess the learners' ability to determine the appropriate application software for each of the files and the skill to navigate and use the different application software.

Senior Five Term II

Topic 7: Electronic Spreadsheets I

Duration: 20 Periods

Background

Throughout the ages, people have always needed to calculate. Tools such as the abacus were invented by the early Chinese to help keep track of large numbers. About thirty years ago, students only had pen, paper, slide rules and mathematical tables to help them in their mathematics exams. There were no such things as calculators and certainly no personal computers. Calculators eventually became everyday tools and certainly helped to speed up calculations and improve accuracy. Even then, they weren't really good enough to solve complex problems or deal with large amounts of repetitive work. With advancement in technology, spreadsheets were developed.

A spreadsheet is a piece of software which is used to work out calculations. Spreadsheets can do a lot more than simply adding up a column of numbers. Spreadsheets can handle financial calculations for a large business, calculate probability or other statistical information, do complex trigonometry and make colorful graphs and charts. Some examples of these spreadsheets include, Microsoft Excel, VisiCalc, Lotus 1-2-3, MS-DOS spreadsheets and OpenOffice.org Calc.

Learning Outcome

The learner should be able to produce mark sheets, budgets, class planners and many others.

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
1. Introduction to Spreadsheets	The learner: • describes a spreadsheet. • identifies some of the available spreadsheets. • identifies features of spreadsheets. • identifies uses of spreadsheets. • performs data	• Meaning of a spreadsheet • Types of spreadsheets • Features of a spreadsheet • Application areas for spreadsheets	• Describing the concept of a spreadsheet • Demonstrating the concept of a spreadsheet • Describing the application areas of spreadsheets • Demonstrating

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
	entry in a worksheet. • renames, inserts and deletes worksheets. • saves a workbook.	• Working with spreadsheets	how to enter and insert data • Demonstrating how to rename, insert and delete a worksheet • Demonstrating how to save a workbook
2. Managing Worksheets	The learner: • inserts rows, columns, and cells in a worksheet. • edits cell content. • selects adjacent or non adjacent range of cells or the entire worksheet. • copies and moves cell contents. • uses the auto fill tool/ copy handle tool. • freezes/unfreezes panes. • formats a worksheet (adjusting column widths, row heights, applying borders and formatting cell content).	• Inserting rows, columns and cells • Editing contents of a cell • Selecting cells • Copying the contents of a cell range, or worksheet between worksheets or workbooks • Auto fill/ copy handle tool • Freezing panes • Formatting a worksheet	• Demonstrating how to insert, edit, select, copy and move cell content in a worksheet • Demonstrating how to copy and paste cell contents • Demonstrating how to use copy handle tool • Demonstrating how to freeze/unfreeze panes • Demonstrating how to format worksheets in a variety of ways

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Sub-Topic	Competences	Content	Teaching/ Learning Strategies
3. Formulae and Functions	The learner: • identifies operators used in spreadsheets. • identifies different types of cell references. • uses formula to manipulate data. • uses function to manipulate data. • identifies standard error values associated with using formulae.	• Types of operators • Types of cell referencing • Formula • Functions (sum, average, max, min, lookup, count, mode, median, frequency and var) • Error alerts	• Demonstrating how to use operators to form basic formulae (addition, subtraction, division, multiplication) • Demonstrating how to write formulae and to use functions • Demonstrating how to use operators, cell references, formulae and functions • Discussing the error alerts associated with use of formulae

Guidance to the Teacher

- Demonstrate to the learners how worksheets are managed before allowing them time to manage their own worksheets.
- Give a clear explanation of the underlying principles of working with specific functions to the learners before they form functions or formulae. For example when a label appears in a logic function, the label is put in double quotation marks.
- Start with the basic formulae that can assist to make a shopping list budget before introducing the functions and order of operations in formulae. Automatic recalculation is expected.

Suggested Competences for Assessment

- Assess the learners' ability to manage the worksheet to meet user specifications/requirements, and use of formulae and functions in worksheets.

Topic 8: Internet and World Wide Web

Duration: 12 Periods

Background

The number of users of the internet is exponentially growing due to increasing ease of use, low cost of the hardware and availability of adequate facilities in schools, public libraries, internet cafes, etc.

Although the basic use of the Internet was research, the number of users of e-mail has outgrown that of research. One can use the internet to communicate with anyone else online, in any place in the world without incurring any extra cost. It can also be used to join mailing list, bulletin boards or discussion groups that cover a huge variety of subjects.

Learning Outcome

The learner should be able to use the Internet to communicate and enhance research in order to develop the lifelong learning skill.

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
1. Introduction to the Internet	The learner: • explains the Internet. • states the advantages and disadvantages of using the Internet.	• Meaning of the Internet • Implications of the Internet	• Explaining the meaning of the Internet • Discussing the advantages and disadvantages of using the Internet
2. Internet Services	The learner: • identifies the different Internet communication services. • uses email to communicate. • uses internet facility for research. • explains the concept of Netiquette	• Internet communication services • Email services • Netiquette	• Demonstrating Internet services • Discussing the concept of Netiquette

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
3. World Wide Web	The learner: • defines a web browser • identifies different web browsers. • defines a search engine. • identifies different search engines. • searches for information from the Web. • uses search engine syntax. • defines a website. • identifies different types of websites. • explains the concept of cloud computing.	• Web browsers • Search engines • Websites • Cloud Computing	• Demonstrating how to use the web browser to connect to the internet • Demonstrating how to use the internet to search for different information

Guidance to the Teacher

- Guide the learners to identify the different internet services and their usefulness.
- Demonstrate effective use of search engines and give learners activities to practise use of refined searches as individuals or in groups.
- Guide the learners to use email communication. You need to make sure that all learners in the class have working email addresses for effective teaching of this topic. Creating an email address is expected.
- As much as possible encourage internet etiquette practices.

Suggested Competences for Assessment

- Assess the learners' ability to search for information from the internet and use email communication in addition to other services covered in this topic.

Topic 9: Computer Word Processing II

Duration: 20 Periods

Background

In computer word processing we looked at the different word processing software and how they can be used to prepare documents. In different professions, institutions or organisations, some documents need to have specific features (look and fill) with relevant images, illustrations and tabulated data.

In word processing II, you will learn how to prepare and email documents with different specifications in mind.

Learning Outcomes

The learner should be able to:

i) prepare documents with tabulated data and objects with varied document layout

ii) prepare documents using mail merge features of word processing software.

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
1. Page Layout	The learner: • adjusts document page setup for margins, orientation and columns. • uses different document view features. • inserts page numbers, pages and section breaks, themes and effects.	• Page setup	• Demonstrating how to prepare page setup
2. Data Tabulation	The learner: • demonstrates, inserts and draws a table in a document. • formats table cells by	• Tables	• Demonstrating table creation methods and approaches.

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
	cell merging, resizing and splitting. • inserts rows and columns. • navigates table cells, enters and manipulates text in the table.		
3. Use of other Software Objects	The learner: • inserts and manipulates text box, lines and colour fill. • uses the character map. • uses basic lines, shapes, arrows and flow charts. • groups and ungroups objects.	• Text box • Word processor objects	• Demonstrating the use of software objects. • Demonstrating the formatting of software objects
4. Document Accuracy	• The learner uses extra document edit features (spell checker, insert comment, track changes, Thesaurus, and synonyms).	• Text editing	• Demonstrating the use of document edit features
5. Mail Merge, Document Referencing, and Printing	The learner: • links content through mail merge, table of contents and hyperlink. • uses document and text referencing through footnotes and end notes. • prints out typeset text and documents.	• Mail merge • Document and content referencing • Printing	• Demonstrating the use of mail merge, document referencing and printing options

Guidance to the Teacher

- You are advised to give the learners an activity or set of activities to develop skills in word processing.
- Use of track changes accepting and rejecting changes is expected.

- You are advised to introduce each skill at a time to allow time for effective acquisition.
- Use of short cuts to navigate through a big document is encouraged
- Image positioning should be practised with different text wrappings.

Suggested Competences for Assessment

- Assess the learners' ability to adjust page layout, check document accuracy, insert and use objects in word processed documents, use mail merge features of the word processing software.

Topic 10: Electronic Presentation

Duration: 32 Periods

Background

Communicating effectively to a big audience is a challenge to many people. It should be noted, however, that versatility of ICTs has played a big role in enhancing the ease and impact of the presentation process.

A presentation programme is supposed to help both the presenter with a range of tools to clearly structure his ideas and offer the participants with multimodal information that is engaging. There are many areas where presentations are used. Some of these include professional (work-related), education, entertainment, and for general communication. Presentation programmes can either supplement or replace the use of older visual aid technology, such as pamphlets, handouts, chalkboards, flip charts, posters, slides and overhead transparencies.

There are a number of presentation software such as Microsoft power point, open office presentation, lotus freelance, Corel presentation, among others. Text, audio, graphics, movies and other objects are positioned on individual pages or slides in a given presentation. The "slide" analogy used in presentation software is a reference to the slide projector, a device that has become somewhat obsolete due to the use of better technologies.

Slides can be printed, or (more usually) displayed on-screen and navigated through at the command of the presenter. Transitions between slides and animation in each slide can be done in a variety of ways. Coming up with a good presentation requires a lot of input: planning, collecting information and constructing.

Learning Outcome

The learner should be able to create and deliver a multimedia presentation.

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
1. Introduction to Electronic Presentation	The learner: • explains a presentation. • identifies examples of presentation	• Meaning of presentation • Examples of presentation software	• Describing the concept of presentation software

Senior Five Term III

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
	software. • explains functions of a presentation software. • identifies principles of a good presentation. • identifies features of a presentation interface. • explains the application areas of a presentation.	• Functions of presentation software • Purpose of a presentation • Features of a presentation software interface • Application areas of a presentation	• Demonstrating the concept of a presentation software • Brainstorming the purpose of a presentation • Brainstorming the factors that affect a good presentation
2. Working with Presentation Software	The learner: • creates presentations based on different appropriate templates. • saves a presentation to a location in different formats.	• Presentation software	• Describing the examples of presentation software • Demonstrating the opening and closing of presentation software • Demonstrating the creation of slides in a presentation • Demonstrating saving presentations in different formats
3. Developing a Presentation	The learner: • uses different presentation views: - normal view	• Presentation views	• Demonstrating different views of a presentation

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
	- slide sorter view - slide show view • changes between presentation views. • inserts slides in a presentation. • chooses most appropriate slide layout. • changes background on specific/ all slides. • copies, moves slide(s) within presentation or between presentations. • deletes slides. • inserts footer on specific slides, all slides in presentation. • edits slides through slide master. • sets automatic slide numbering, automatic dates, non-updating dates into footer of slide master.	• Slide design • Slide master	• Discussing the best practices in creating a presentation • Demonstrating formatting of a slide

Senior Five Term III

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
4. Charts	The learner: • creates a chart from data entered within a slide in a presentation. • imports data from other applications such as spreadsheets to create charts. • imports charts from some applications. • identifies chart types of a presentation software. • inserts an organisation chart. • modifies an organisation chart.	• Charts • Chart types • Organisation charts	• Demonstrating the creation of charts using different methods in a presentation • Discussing the chart types in a presentation • Collecting data on the organisation structure of a school • Adding an organisation chart in a slide of a presentation using the data collected

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
5. Graphical Objects	The learner: • identifies different types of graphics (ClipArt, picture, auto shapes) that can be used in presentation software. • inserts the different types of graphics on a slide. • manipulates the position and size of the graphic to requirements. • applies shape effects on graphics on the slide. • inserts text box on a slide. • organises graphics on a slide.	• Graphics	• Making a collection of the different types of graphics • Describing the different types of graphics that can be used in a presentation • Demonstrating how to insert a graphic on a slide • Demonstrating how to manipulate graphics on the slide
6. Presentation Output	The learner: • defines transitional effects. • shows knowledge of using transitional effects. • shows knowledge of using animation effects. • adds presenter notes on a slide. • creates links between slides and other files.	• Transitional effects • Animation effects • Presenter notes • Navigation • Output	• Demonstrating transitional effects • Demonstrating various animation schemes • Discussing the purpose of transitional and animation effects • Demonstrating how to add presenter

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
	• re-arrange slides. • identifies output formats of a presentation. • checks spelling. • saves a presentation in appropriate output formats. • chooses printer options.	format of a presentation • Print a presentation	notes • Discussing different output formats of a presentation • Demonstrating use of links between slides • Demonstrating proofreading for spell-check and grammar • Demonstrating the printing options of a presentation
7. Slide Show	The learner: • sets up a slide show to run manually or automatically. • runs a slide show from current slide.	• Slide show	• Demonstrating how to set up a slide show

Guidance to the Teacher

- Introduce a class presentation project from the beginning and continue working on the project as the topic progresses
- Emphasise correct use of images and text (font size and style) depending on the end users for whom the presentation is intended. The font size and type of images meant for a presentation to children is different from the presentation to adults.
- You should prepare presentations for learners to critique and generate ideas on what a good presentation should be, with reasons.
- You are advised to use demonstrations for each of the skills being introduced.
- Give learners an opportunity to observe, and allow them to practise and develop the skills individually or in groups if the equipment allow. As

much as possible, give each learner a chance to develop the skills in the topic.

- Give assignments where learners prepare and deliver presentations to the rest of the class so that they can develop confidence in delivering a presentation.

Suggested Competences for Assessment

- Assess the learners' ability to create an informative presentation, deliver a presentation to an audience and customise a presentation to meet end user needs.

Topic 11: Data Communication and Networking

Duration: 18 Periods

Background

Communication is one of the fundamental aspects of life. In this regard, electronic communication means have been developed on top of the traditional manual and mechanical modes of communication for individuals and organisations to communicate more effectively. A person can now communicate through contemporary media like mobile phones and over the internet.

It is therefore important that learners are introduced to basic data communication and ICT networking infrastructure and services in order to come to terms with contemporary data communication facilities.

Learning Outcome

The learner should develop basic skills, knowledge and expertise in the use of contemporary communication facilities like computers, mobile telephones, the Internet, among others.

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
1. Introduction to Data Communication	The learner: • defines data communication. • explains the elements of data communication (sender, receiver, messages, transmission media and protocol). • defines data communication tools. • describes types of electronic data communication	• Data communication • Elements of data communication • Data communication tools • Data transmission media	• Demonstrating data communication • Discussing the concept of data communication

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
	tools like computers, mobile phones, the Internet, among others. • compares electronic and manual data communication tools (manual drums, bells and messengers). • defines data transmission media. • differentiates between physical transmission media and wireless transmission media (Bluetooth and broadcast radio transmission media). • describes services offered by data communication tools like E-mail, Skype, News groups, and instant messaging. • explains the implications of using data communication services.	• Data communication services	

Senior Six Term I

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
2. Introduction to Computer Networks	The learner: • defines a computer network. • explains the basic requirements for setting up a computer network (Routers, transmission media, modems and network software like windows internet explorer. • explains the implications of computer networks. • identifies different types of computer networks (• LAN, MAN, WAN). • explains the Network models (Client-server, and Peer-to-peer).	• Computer networks • Computer network models	• Demonstrating computer network • Discussing the concept of computer networks

Guidance to the Teacher

- It is important for the learners to interact with all the data communication tools mentioned in this topic for them to appreciate and clearly make a distinction between their usage.
- You are advised to use physical network devices as visual aids for the learners to visualise and learn from.
- Prepare activities that allow learners to work individually or in groups to identify and list the components of a computer network and their uses, to identify and list the implications of a computer network.

Suggested Competences for Assessment

- Assess the learners' ability to effectively communicate using data communication tools and explain the types of computer networks.

Senior Six Term I

Topic 12: Electronic Publication

Duration: 32 Periods

Background

Electronic publishing has a history of being used to describe the development of new forms of production, distribution, and user interaction in regard to computer-based production of text and other interactive media.

Electronic publishing enables professional designers to create sophisticated documents that contain text graphics and many colours. It is ideal for the production of high quality colour documents such as textbooks, corporate newsletters, marketing literature (adverts), product catalogues and annual reports, and being able to share them over the Internet.

Learning Outcome

The learner should be able to design a brochure, business card, flyer or banner for a given function.

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
1. Introduction to Electronic Publishing	The learner: • defines electronic publishing. • identifies different types of electronic publishing software. • identifies features of electronic publishing software. • identifies uses of electronic publishing.	• Meaning of electronic publishing • Examples of electronic publishing software • Features of electronic publishing software • Application areas for electronic publishing	• Analysing the concept of a electronic publishing • Listing different types of electronic publishing software • Brainstorming features of electronic publishing software

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
2. Publishing Basics	The learner: • creates a new document. • adjusts measurement units (inches, pixels, points, centimetres). • save a new document. • typesets text.	• New document	• Demonstrating the creation of a new document • Typesetting text in a document • Presenting a document to peers
3. Document Enhancement	The learner: • changes background colour. • inserts text boxes. • inserts graphics. • inserts page borders. • formats text. • imports text. • adds page numbers. • checks spelling. • changes spacing.	• Object properties	• Manipulating e-publisher object properties • Researching on different object properties, using them and presenting findings to peers
4. Document Layout	The learner: • aligns a document. • distributes graphics in a document. • organises text along objects. • customises page size.	• Layout	• Developing a sample publication like a certificate • Presenting to peers the document

Senior Six Term I

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
5. Advanced Features	The learner: • customises templates. • uses templates. • uses auto shapes. • completes a document (certificates, brochures, flyers, menus and so on).	• Templates • Auto shapes • Designs	• Demonstrating application of templates in electronic publishing • Designing a complete publication project • Presenting the project to peers

Guidance to the Teacher

- For each of the items to be developed in this topic, let the learners develop, make a presentation of their designed item for the rest of the class to comment and make improvements in the item. Where possible, get a third party to determine what they need in order to advertise a product.
- Discourage the learners from using inbuilt templates while designing each of the items.
- Train learners how to adjust the units of measurement from inches, to pixels and to centimetres for learners to develop this competence.
- You are advised to organise the teaching in form of a project to allow the learner develop specific skills at a time.
- As much as possible demonstrate to learners and allow them time to develop the skills of their own through the project work.

Suggested Competences for Assessment

- Assess the learners' ability to create and design an electronic publication in form of a flyer or banner to a level of advertising an item.

Topic 13: Electronic Spreadsheets II

Duration: 18 Periods

Background

In electronic spreadsheet I, we looked at the introduction, working with spreadsheets and managing worksheets. We also looked at the formulas and functions which help in the manipulation of data. We are now primed with the task of presenting the information. We have to look at the appearance of our spreadsheet i.e. text attributes, cell, column, and row attributes plus the general page layout.

Some spreadsheets can become very big and complex, especially the ones which are used to keep track of records over time. Most people find a large table of data hard to analyse, that is to say it is almost impossible to tell at a glance what is happening over a long period of time. For example, by simply looking at result sheets of a given school, it is not easy to tell the trend in performance of UNEB exams over a given period. Graphs and charts make it easier for us to analyse and understand the patterns in data.

In this section, we address formatting worksheets, working with charts, and preparing outputs

Learning Outcome

The learner should be able to produce a student performance analysis report and prepare it for printing.

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
1. Working with Charts	The learner: • creates a chart. • inserts chart titles. • inserts legends. • inserts backgrounds. • inserts segment labels. • resizes the chart. • edit the data range. • selects the appropriate chart	• Charts • Data types (trends, linear, composite) • Chart selection	• Demonstrating how to create different charts • Demonstrating how to insert legends, backgrounds and segment labels • Demonstrating

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
	for a given set of data.	criteria	how to edit charts • Exploring chart types vis-à-vis data
2. Worksheet Page Layout	The learner: • adjusts margins. • determines the appropriate page orientation. • changes page orientation. • inserts headers. • inserts footers. • inserts page numbers. • inserts, date and time. • selects the appropriate paper size.	• Page setup	• Demonstrating how to adjust and change a worksheet page layout • Guided discovery on page orientation and use of headers and footers
3. Printing a Worksheet	The learner: • previews a worksheet. • highlights a range to print or prints the entire worksheet.	• Printing • Worksheet preview	• Demonstrating how to print a worksheet

Guidance to the Teacher

- Demonstrate to the learners how to create and manipulate charts from a worksheet, adjusting the orientation and use of other objects like dates, page numbers, headers and footers. Give learners an activity that requires them to use the skills demonstrated in an assignment. It is important the assignment is done on individual basis.
- Put emphasis on printing to make sure that the learner is able to print only the required number of pages. This will only be achieved through practice.

Suggested Competences for Assessment

- Assess the learners' ability to create and edit, and interpret charts derived from data in a spreadsheet.

Topic 14: Databases

Duration: 32 Periods

Background

Think of an address book you might buy in a bookshop. In it, you will write all your important contacts; friends, family, relatives, companies, and other people in your circles. The address book contains all names, addresses, location, phone numbers of whoever you need to contact at any time.

The world generates an enormous amount of data from almost every aspect of life; school records, credit cards, store merchandise, telephone systems and web sites, among others. Some time ago, manual effort was used to track and report this information. Today, database management systems manage this information.

Learning Outcome

The learner should be able to create and query a simple database.

Sub-Topic	Competences	Content	Learning/ Teaching Strategies
1.Introduction to Databases	The learner: • defines a database. • identifies examples of Database Management Systems. • describes features of Database Management System interface. • creates a database. • saves a database.	• Meaning of a database • Examples of Database Management Systems • Features of Database Management System interface • Database	• Describing the concept of a database • Demonstrating the concept of a database
2. Database Objects	The learner: • creates a table in a database. • modifies a table in a database. • creates forms in a	• Tables in database • Forms in database	• Demonstrating the creation of a database table • Discussing the

Sub-Topic	Competences	Content	Learning/ Teaching Strategies
	database. • uses forms to insert records. • uses forms to modify records. • generates queries in a database. • creates database reports. • modifies database reports. • prints database reports.	• Queries in database • Database reports • Printing a database deport	structure of the created database tables • Making a database project

Guidance to the Teacher

- You are advised to use the Ms Access or any other database management system that uses a GUI. No knowledge of sql commands is expected.
- Using demonstration, guide the learners to take note of the procedures of creating and saving a relational database.
- Group the learners or give them individual activities to enable them develop hands-on skills to create databases with appropriate relations, identify features of database development software and their uses.
- Demonstrate to the learners the process of adding fields, field names, and specifying data types for a database.
- Assess the learners' correct use of database terms, create and query databases to form reports.
- Where possible, prepare a project activity for learners to keep adding on to their skills as they progress with the topic.

Senior Six Term II

Suggested Competences for Assessment

- Assess the learners' ability to create and query the database using a low end database management system.

Topic 15: System Security, ICT Ethical Issues and Emerging Technologies

Duration: 24 Periods

Background

As computers get involved in almost all aspects of our lives, there are quite a number of issues emerging that need extra attention. Such emerging issues range from computer system features, environmental concerns, legal and ethical issues, system security and users of computer applications. Therefore, it is increasingly becoming important that students of ICT learn how to safeguard their computer systems, uphold ethical values while using ICT systems as they explore emerging technologies.

Learning Outcome

The learner should be able to explain and discuss the emerging issues, computer security and privacy issues.

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
1. Computer System Security	The learner: • explains the various forms of computer security (data and physical security). • identifies security threats (hardware and software). • explains the meaning of a computer virus. • explains how viruses are spread on standalone and networked computers.	• Computer security • Internet and network attacks	• Describing the concept of computer system security • Discussing the possible threats to computer systems • Discussing the available control measures to computer system attacks

Senior Six Term III

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
	• explains the concept of hacking. • explains how denial of service attacks, backdoors, spoofing are carried out. • identifies appropriate ways of protecting data in computer systems. • identifies types of computer crimes	• Data protection in computer systems • Computer crime	• Describing the concept of computer crime
2. Privacy and ICT Ethical Issues	The learner: • defines ethical issues in ICT. • describes ethical issues in ICT. • describes information accuracy. • explains the concept of intellectual property rights. • explains the concept of green computing. • explains the concept of information privacy.	• ICT ethics and society • Intellectual property • Information privacy	• Describing the concept of privacy and ICT ethical issues • Describing the concept of information privacy and violation

Sub-Topic	Competences	Content	Teaching/ Learning Strategies
	• explains the different aspects of information privacy and violation.		
3. Emerging Technologies	The learner: • explains the concept of emerging technologies (artificial intelligence, digital forensics, among others). • explains how specific technologies are applied in problem-solving in society. • explains advantages and disadvantages.	• Emerging technologies • Application areas of specific emerging technologies • Implications of emerging technologies	• Describing the concept of emerging technologies • Discussing the application areas of emerging technologies in society • Discussing the implications of the emerging technologies
4. ICT Industry	The learner: • explains the meaning of careers in the ICT industry. • appreciates careers in the ICT industry. • identifies the potential of ICTs for earning.	• Careers in the ICT industry • ICT in SMEs	• Discussing careers in the ICT industry • Brainstorming opportunities on earning with ICTs

Guidance to the Teacher

- For each of the sub-topics in this topic, you are advised to emphasise use of teacher guided research, peer presentation and discussion methods. Prepare a set of questions that require the learner to research and make a presentation of findings to the rest of the class. The presentations should give facts and defend those facts using examples where possible.
- Allow learners to be active and lead their own learning. Let your comments come in at the last point to clarify where consensus cannot be reached.

Suggested Competences for Assessment

- Assess the learners' ability to articulate issues of emerging technologies and their implications to society. The learners' personal interpretation and contribution should be emphasised in view of the issue under discussion.

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Annex 1: Basic Requirements for Teaching Subsidiary ICT

The Subsidiary ICT syllabus is a practical subject. It therefore requires both the student and teacher to have all the necessary equipment in order to have the syllabus properly implemented.

For a school to teach and successfully implement the A Level Subsidiary ICT curriculum, and for the students to attain and achieve the expected skills and competences as stipulated in the syllabus, the following basic or minimum requirements need to be instituted in the computer Lab and / or in classroom, and have them accessible to both learners and teachers.

1. Desktop personal computers or Laptops (for students' and Teachers' use)
   - Intel Pentium 4 (2.0 GHz+) or AMD Processor (1.5GHz+)
   - 512 MB Ram
   - 80 GB HDD
   - DVD/CD-RW, Combo Drive
   - 17"/19 CRT Monitor
   - Computer speakers /keyboard/mouse
2. A closed and simple Computer Network with at least one Network hub
3. Fire extinguisher
4. Safe electrical installation (Provide a socket for each computer set)
5. Uninterruptible Power Supply (UPS) units
6. Internet connectivity
7. Printer accessible on a network

It is important to keep the number of students per computer as low as possible (recommended to this subject is a ratio of 1 computer: 2 learners per stream) if learners are to have access and good practice in the subject.

Volume10 comprises **Subsidiary Mathematics** and **Subsidiary Information Communication Technology (ICT)** teaching syllabi for Advanced Level of Education in Uganda. It gives a clear breakdown of the subject content to be taught per term for each of the subjects. In each syllabus, the specific objectives have been clearly identified and the content spelt out together with suggested approaches to give better guidance to the teacher and other users, in order to simplify the teaching/learning process.

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