THE REPUBLIC OF UGANDA
Ministry of Education and Sports

# ADVANCED SECONDARY CURRICULUM

# TECHNICAL DRAWING SYLLABUS

NCDC
NATIONAL CURRICULUM DEVELOPMENT CENTRE

2025

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# TECHNICAL DRAWING SYLLABUS

2025

A product of the National Curriculum Development Centre for the Ministry of Education and Sports with support from the Government of Uganda

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**ISBN:** 978-9970-675-42-5

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# FOREWORD

The Ministry of Education and Sports, through the National Curriculum Development Centre (NCDC), aligned the Advanced Level Curriculum with the competency-based Lower Secondary Curriculum (LSC) to ensure a smooth learner transition from lower secondary to advanced level.

The two-year aligned Advanced Secondary Curriculum adopted learner-centered approaches, inquiry-based, and discovery methods. The learning outcomes give the learner hands-on experiences in real-life situations while being cognizant of different learner abilities and learning styles. The syllabus focuses on assessment for learning with emphasis on criterion-referenced assessment. It further provides learners with the opportunity to enhance the 21st-century skills and values that were acquired at the lower secondary level.

This Technical Drawing syllabus fosters learners' creativity and innovation by integrating geometric and engineering principles to enhance the effective communication of design ideas. It emphasises the application of mechanical and building construction techniques to address societal challenges while promoting environmental conservation. The syllabus also promotes acquisition of Higher-order Thinking Skills (HOTS) such as inquiry, creativity and innovation, decision-making, critical thinking and problem-solving. It advocates for learner centred pedagogies that engage learners in hands-on experience within real-life contexts, taking into account the diverse abilities and learning styles of individual learners.

As the Minister responsible for Education, I endorse this syllabus as the official document for teaching and learning Technical Drawing at the Advanced Level of secondary education in Uganda.

Hon. Janet Kataaha Museveni
**First Lady and Minister of Education & Sports**

# ACKNOWLEDGEMENTS

The National Curriculum Development Centre (NCDC) is indebted to the Government of Uganda for financing the alignment of the Advanced Level Curriculum to Lower Secondary Education in Uganda.

Our gratitude goes to the Ministry of Education and Sports for overseeing the adaptation of the curriculum, the Curriculum Task Force of the Ministry of Education and Sports for the oversight role and making timely decisions whenever necessary, and members of the public who made helpful contributions towards shaping this curriculum.

NCDC is also grateful to Members of Parliament, schools, universities, and other tertiary institutions, the writing panels, and professional bodies, for their input in the design and development of the Advanced Level Curriculum. To all those who worked behind the scenes to finalise the adaptation process of this teaching syllabus, your efforts are invaluable.

NCDC takes responsibility for any shortcomings that might be identified in this publication and welcomes suggestions for effectively addressing the inadequacies. Such comments and suggestions may be communicated to NCDC through P. O Box 7002, Kampala, or Email: admin@ncdc.go.ug or on the Website: www.ncdc.go.ugwww.ncdc.go.ug

Dr Grace K. Baguma

**Director**

**National Curriculum Development Centre**

# 1.0 INTRODUCTION

The Advanced Secondary Curriculum has been aligned with the Lower Secondary competency-based model for ease of progression of learners from the Lower to Advanced Secondary Level. The alignment is a result of the analysis of the Advanced Level Curriculum published in 2013, to determine whether the content is:

i) Appropriate.
ii) High-pitched or overload.
iii) Covered at lower secondary.
iv) Obsolete.
v) Repeated in different topics.
vi) Redundant.

The results from the curriculum analysis revealed that there were overlaps of concepts with what was covered at the Lower Secondary, as well as concepts within different topics of the same subject. In addition, a number of syllabuses had content that is no longer necessary for today's contemporary society and the 21st century.

## 1.1 Changes in the Curriculum

The alignment of the A-Level Curriculum to that of the Lower Secondary led to changes in the pedagogies of learning from a knowledge- and objective-based, to an integrated and learner-centred competency-based approach. The adapted syllabus, therefore, is a result of rationalising, integrating, and merging content with overlaps and similar skills, dropping topics that had been studied at Lower Secondary, or are no longer critical and relevant for the current learning needs, while upgrading those that were of low competencies to match with the advanced level. The programme planner details the learning progression derived from the learning outcomes. The detailed syllabus section unfolds the learning experiences with corresponding assessment strategies.

This Technical Drawing syllabus is part of the Advanced Secondary Curriculum. The teacher is encouraged to read the whole syllabus before planning your teaching programme, since many topics have been merged, upgraded, or removed. While aligning this syllabus, efforts were made to ensure a smooth progression of concepts from the Lower Secondary Level, adapting topics and content with familiar features that are of value to the learner and society. In addition, the process of developing this syllabus document removed what was considered obsolete, high pitched as well as content overlaps and overloads.

## 1.2 Classroom-Based Assessment

This syllabus requires classroom learning to be experiential, through the suggested learning activities for the acquisition of the learning outcomes. This is the gist of a learner-centred and activity-based approach to learning, which emphasises the acquisition of required competencies. Formative assessment in Technical Drawing will focus on the acquisition of

knowledge and skills, through performance of the learning activities. The learning activities sprout from the learning outcomes, which are evidenced by acquiring and demonstrating the application of the desired skills, to show that learning has taken place. The sample assessment strategies have been provided to guide the teacher on classroom-based assessment. The teacher can develop more assessment strategies based on the same principles of observation, conversation, and product, for the acquisition of the desired knowledge, skills, values, and attitudes. (See detailed syllabus)

## 1.3 Learners with Special Educational Needs

The Advanced Secondary Curriculum is designed to empower all learners, including those with Special Educational Needs (SEN), to reach their full potential and contribute meaningfully to the nation. By incorporating inclusive strategies, the curriculum ensures equitable access to high-quality learning opportunities while maintaining high academic standards. It emphasises creating an inclusive learning environment that supports the diverse needs of learners with SEN, enabling them to succeed alongside their peers.

## 1.4 Generic Skills

Generic skills are embedded within all subjects and are essential for learning and workforce readiness. These skills enable learners to engage with the entire curriculum effectively and prepare them for lifelong learning. These skills equip learners with the ability to adapt to change and navigate life's challenges in the 21st century.

**The key generic skills include:**

1

**Critical thinking and problem-solving**

i) Planning and carrying out investigations
ii) Sorting and analysing information
iii) Identifying problems and proposing solutions
iv) Predicting outcomes and making reasoned decisions
v) Evaluating different solutions

**Co-operation and Self-Directed Learning**

i) Working effectively in diverse teams
ii) Interacting effectively with others
iii) Taking responsibility for own learning
iv) Working independently with persistence
v) Managing goals and time

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**Creativity and Innovation**

i) Using imaginations to explore possibilities
ii) Working with others to generate ideas
iii) Suggesting and developing new solutions
iv) Experimenting with innovative alternatives
v) Looking for patterns and making generalisation

**Communication**

i) Listening attentively and with comprehension
ii) Talking confidently and explaining ideas/opinions clearly
iii) Reading accurately and fluently
iv) Writing and presenting information coherently
v) Using a range of media to communicate ideas

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5

**Mathematical Computation**

i) Using numbers and measurements accurately
ii) Interpreting and interrogating mathematical data
iii) Using mathematics to justify and support decisions

**Information and Communication Technology (ICT) Proficiency**

i) Using technology to create, manipulate and process information
ii) Using technology to collaborate, communicate and refine work

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**Diversity and Multicultural Skills**

i) Appreciate cultural diversity
ii) Respectfully responding to people of all cultures
iii) Respecting positive cultural practices
iv) Appreciating ethnicity as a cradle for creativity and innovation

## 1.5 Cross-cutting Issues

These are issues which young people need to learn about, and are not confined to a particular subject but are studied across subjects. They help learners to develop an understanding of the connections between the subjects and the complexities of life as a whole. They are:

i) Environmental awareness.
ii) Health awareness.
iii) Life skills.
iv) Mixed abilities and involvement.
v) Socio-economic challenges.
vi) Citizenship and patriotism.

These are a concern to all mankind irrespective of their areas of specialty. They are embedded in the learning outcomes of the different subjects.

## 1.6 Values

The curriculum is based on a clear set of values. These values underpin the whole curriculum and the work of schools. Learners need to embrace these values as citizens of Uganda. The values are derived from the Uganda National Ethics and Values Policy of 2013. They are:

i) Respect for humanity and environment
ii) Honesty, uphold and defend the truth at all times
iii) Justice and fairness in dealing with others
iv) Hard work for self-reliance
v) Integrity; moral uprightness and sound character
vi) Creativity and innovation
vii) Social responsibility
viii) Social harmony
ix) National unity
x) National consciousness and patriotism

These are neither taught directly in lessons, nor assessed through pen and paper methods. They are incorporated in some learning outcomes and developed as learners progress.

## 1.7 ICT Integration

The integration of ICTs into teaching and learning is strongly encouraged in this A-level adapted curriculum. ICT enhances the implementation of competency-based learning by fostering learner engagement, creativity, and lifelong learning. Teachers are encouraged to use technology to create interactive content, such as digital simulations and videos, to illustrate abstract or complex concepts effectively. Integrating ICT not only enhances the learning experience but also equips learners with essential digital skills for the 21st century.

ICT teachers should endeavour to assist other subject teachers in making the ICT integration process a reality. The table below shows a sample of suggested ICT tools that may be applied to given tasks.

| Sample Task in the Syllabus | Suggested ICT Tool |
|---|---|
| Fieldwork | Use of cameras to take photos and record videos |
| Locate places on a map | Use digital maps such as Google Maps or an equivalent application. |
| Presentation in class | Use presentation applications or online presentation tools like Canva |
| Search for keywords and meanings | Use an online dictionary or search online |
| Make drawing/graphics | Use drawing tools like Draw.io or publishing software/Word processor |
| Roleplay, narrations | Use audio and video recordings |
| Demonstrations | Use audio/video recordings, models, simulations, or virtual labs |
| Analyse and present data | Use spreadsheet software or any other analytics tools |
| Group discussions | Mind mapping software |
| Search for extra reading materials | Download files from the Internet from academic Databases |
| Writing equations and formulae | Use equation editors like MathType |
| Carry out academic search/research | Use the Internet, AI models, and other academic applications like "Encarta", "Britannica", etc. |
| Collaborate with others across the world | Form learning networks with blogs, social media, emails, and videoconferencing tools like Zoom, MS Teams, Webex, Google Meet or any other networking application. |

## 1.8 Projects

Projects and project-based learning are fundamental to 21st century education. In Technical Drawing, these approaches will provide learners with hands-on experience, develop essential skills and better prepare them for a career in engineering and related fields. The learner will be required to design and draw complex systems, creating real-life objects, models or prototypes. The learner will also connect Technical Drawing to other subjects like Physics and Mathematics,

in a single project, promoting a holistic understanding of the materials. This project bridges theory and practice, fosters research, and keeps learners motivated to prepare them for academic success and real-life challenges.

Teachers are encouraged to guide learners to engage in projects that are easily linked to their local environment, enhancing the relevance and applicability of their work.

## 1.9 The Aims of Secondary Education

The aims of secondary education in Uganda are to:

i) Instill and promote national unity, an understanding of the 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.

ii) Promote an appreciation and understanding of the cultural heritage of Uganda including its languages.

iii) Impart and promote a sense of self discipline, ethical and spiritual values, personal and collective responsibility and initiative.

iv) Enable individuals to acquire and develop knowledge and an understanding of emerging needs of society and the economy.

v) Provide 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 socio-economic development of Uganda.

vi) Enable individuals to develop basic scientific, technological, technical, agricultural and commercial skills required for self-employment.

vii) Enable 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.

viii) Lay the foundation for further education.

ix) Enable the individual to apply acquired skills in solving problems of community, and to develop a strong sense of constructive and beneficial belonging to that community.

x) Instill positive attitudes towards productive work and strong respect for the dignity of labour and those who engage in productive labour activities.

xi) Develop a positive attitude towards learning as a lifelong process.

## 1.10 Aims of the Advanced Secondary Curriculum

The aims of the Advanced Level Curriculum are to:

i) Adopt a competency-based learning approach.
ii) Develop holistic education for personal and national development based on clear shared values.
iii) Develop key skills which are essential to work and life and promote life-long learning.
iv) Adopt an integrated approach to learning that develops the ability of learners to apply what they have learned.
v) Improve on assessments by incorporating school-based assessment into the end of cycle assessment.
vi) Emphasise the learner's participation through engagement with the community.
vii) Prepare learners for further education.

## 1.12 Rationale for Teaching Technical Drawing at Advanced Level

The Advanced Level Technical Drawing syllabus aims to:

i) Equip learners with essential skills to visualise, conceptualise and effectively communicate design ideas.
ii) Integrate geometric and engineering principles to foster creativity and innovation, enabling learners to address community challenges with critical thinking and technical precision.
iii) Utilise mechanical and building construction techniques to prepare learners for meaningful contributions to societal challenges, including sustainable infrastructure development, efficient resource utilisation, and innovative product design.
iv) Promote environmental stewardship by encouraging practices and design approaches that emphasise conservation and sustainable development.
v) Develop transferable skills such as spatial reasoning, attention to detail and the practical application of theoretical knowledge, equipping learners to excel in fields like engineering, architecture and industrial design.
vi) Support individual growth by preparing learners to drive technological and societal advancement as part of a skilled workforce.

## 1.11 Subject Overview

Technical Drawing has been re-organised within the syllabus to come up with the adapted version. This version is divided into two main sections; the Building Construction Option and the Mechanical Construction Option. It is the teacher's responsibility to guide learners in selecting the option that best aligns with their interests and abilities.

**a) Building Construction subject Overview**

In the Building Construction subject, the revised areas of study are:

i) **Geometrical Design and Drawing Fundamentals:** This area serves as the foundation for creating precise and accurate representations of shapes, structures and objects.

Studying these basics is essential for learners to develop technical and creative skills necessary for architectural, engineering and industrial design projects. Additionally, it examines social and environmental considerations when exploring materials and processes to create products that benefit society.

ii) **Building design Basics:** This area covers the fundamental principles, materials and processes involved in designing and constructing building structures. Studying these basics is crucial for learners to develop skills in designing buildings.

iii) **Building Construction practices:** These are established methods and techniques used in the construction industry to design, plan and execute building projects. This encompasses a wide range of activities, from site preparation to the finishes on a structure and include the development of functional models and prototypes that are used for testing, presentation and further improvement.

**b) Mechanical Construction Subject Overview**

i) **Geometrical Design and Drawing Fundamentals:** This area provides the foundation for creating precise and accurate representations of shapes, structures and objects. These basics are crucial for learners to develop the technical and creative skills needed to produce detailed technical drawings and design mechanical components and systems for society and industrial projects. Additionally, it addresses social and environmental considerations when selecting materials and processes to create products that positively impact society.

ii) **Mechanical drawing basics:** This is the foundational knowledge and skills required for designing, constructing and assembling mechanical systems and components. (such as gears, pulleys, belts) and their functions within a system. It includes understanding the principles, materials and processes involved in creating mechanical structures and devices.

iii) **Mechanical practices:** This area involves hands-on techniques, methods, and skills used in the design, construction and operation of mechanical systems and components. It emphasises the practical application of mechanical knowledge, allowing learners to develop models, prototypes and real-life products that build proficiency in constructing and maintaining mechanical systems**.**

## 1.3 Time Allocation

The learners shall be engaged for eight (8) periods per week from senior five to senior six for each of the subject areas (building or mechanical construction).

## 1.14 Suggested Approaches to Teaching Technical Drawing

The approaches suggested below enhance learning and empower teachers to support learners in preparing for assessments. Teachers should work closely with learners, offering guidance, direction, support and supervision throughout the demonstration and practice phases. These approaches include:

1. **Inquiry-based learning**: Learners are encouraged to conduct research based on their interests and solve problems through a series of questions and scenarios. This approach enhances critical thinking, communication and research skills.
2. **Experiential learning**: Learners actively participate in hands-on experiences during research and learn by reflecting on their activities. This approach leads to the development of reflective skills.
3. **Problem and project-based learning**: Learners find solutions to problems through their experience in research and projects. This leads to development of critical thinking, social and research skills.
4. **Case-based learning**: Learners discuss and analyse real world scenarios. This enables them to develop critical thinking, analytical and research skills.
5. **Discovery learning**: Learners build their own knowledge through active participation, exploration and inquiry. This approach encourages them to think critically, ask questions and formulate hypotheses through research.

## 1.15 Program Planner

The Technical Drawing program planner is divided into two distinct categories: the Building Construction program planner and the Mechanical Construction program planner. **A learner may choose to pursue either Building Construction or Mechanical Construction, but not both**.

**Geometrical and Building Construction Program Planner**

| Class/Term | Topic | Sub-topic | Periods |
|---|---|---|---|
| **Senior Five Term 1** | 1. Projections of Solids | 1.1 Isometric Projection<br>1.2 Orthographic Projection (first & third angle) | 40 |
| | 2. Foundations and Floors | 2.1 Foundation and Floor Design (sections) | 20 |
| **Senior Five Term 2** | 3. Foundations and Floors | 3.1 Construction of Strip Foundations<br>3.2 Construction of Solid Ground Floors | 36 |
| | 4. Surface Development | 4.1 Lines in Space<br>4.2 Development by Triangulation<br>4.3 Panel Development | 44 |

| | | | |
|---|---|---|---|
| **Senior Five Term 3** | 5. Wall Designing | 5.1 Wall Partitioning<br>5.2 Window and Door Schedules<br>5.3 Wall Construction | 80 |
| **Senior Six Term 1** | 6. Vector Geometry | 6.1 Concurrent and Non-Concurrent Co-Planar Forces<br>6.2 Forces in Beams and Frameworks | 40 |
| | 7. Intersection of Solids | 7.1 Intersection of Solids | 40 |
| **Senior Six Term 2** | 8. Roofs | 8.1 Roof Design (gable and hipped) for L and T Shapes<br>8.2 Roof Construction (prototyping) | 80 |
| **Senior Six Term 3** | 9. Building Drawing | 9.1 Gable, Hipped and Combined (hipped and gabled) Roofed Bungalow Building in L and T Shapes<br>9.2 Site Designing (prototyping) | 48 |

## Geometrical and Mechanical Program Planner

| Class and Term | Topic | Sub-topic | | Periods |
|---|---|---|---|---|
| **Senior Five Term 1** | 1. Machine Drawing | 1.1. | Isometric Projection | 12 |
| | | 1.2. | Orthographic Projection | 12 |
| | | 1.3. | Mechanical Fasteners<br>Types and Application of Fasteners | 36 |
| **Senior Five Term 2** | 2. Machine Drawing | 2.1 | Dimensioning | 10 |
| | | 2.2 | Limits and Fits | 16 |
| | | 2.3 | Machine Parts Drawing | 54 |
| **Senior Five Term 3** | 3. Power Transmission Systems | 3.1 | Elements of Power Transmissions | 36 |
| | | 3.2 | Loci<br>i) Cycloids<br>ii) Helix<br>iii) Involutes<br>*iv)* Spirals, etc | 36 |
| | | 3.3 | Gears (involute spur gears) | 8 |

| | | | | |
|---|---|---|---|---|
| **Senior Six Term 1** | 4. Power Transmission Systems | 3.4 | Link Mechanisms | 24 |
| | | 3.5 | Cams | 24 |
| | 5. Surface Development | 3.6 | True Lengths of Lines | 32 |
| **Senior Six Term 2** | 6. Surface Development | 3.7 | Development by Triangulation | 16 |
| | | 3.8 | Panel Development | 10 |
| | 7. Intersection of Solids | 3.9 | Sectioning Method | 42 |
| | | 3.10 | Auxiliary Method<br>*i)* Cone/pyramid and<br>*ii)* cylinder/prism | 12 |
| **Senior Six Term 3** | 8. Vector Geometry | 3.11 | Graphical Resolution of Forces | 48 |

## 1.16 Note to Users

Each topic has a competency, which is a broad statement that brings out what the learner is expected to do at the end of the topic. The competency is broken down into learning outcomes, for which suggested learning activities and sample assessment strategies are developed as represented in the three columns below.

| Learning outcomes | Suggested learning activities | Sample assessment strategy |
|---|---|---|
| A statement of the knowledge, understanding, skills, generic skills, values, and attitudes expected to be learned by the end of the topic. Hence each learning outcome is coded with some of these as **k, u, s, gs and v/a** for emphasis to the teacher on what to consider during the lesson. | The sort of hands and minds on engagements, which enable the learner to achieve the learning outcome including the generic skills and values. They are designed to enable learners to Discover, Explain, Apply and Analyse (**DEAA**) as they participate in knowledge construction. | Opportunities for assessment within the learning process that is, during and after the lesson. |

The learning activities and assessment strategies in the syllabus are "suggested" and "samples" respectively and not exhaustive. Teacher is encouraged to develop more learning activities and assessment strategies that are based on the learning outcomes. In addition, teacher is free to customise the suggested learning activities to make them suitable for their respective learning environments and for learners with Special Educational Needs (SEN).

# 2.0 DETAILED SYLLABUS

The detailed syllabus for Technical Drawing is organised into two distinct categories: Geometrical and Building Construction syllabus and Geometrical and Mechanical Construction syllabus.

## GEOMETRICAL AND BUILDING CONSTRUCTION SYLLABUS

## SENIOR FIVE TERM 1

## TOPIC 1: Projection of Solids

**Duration:** 40 Periods

**Competency:** The learner applies drafting skills and standards by creating visual representations to communicate ideas in the engineering industry.

| **Learning Outcomes**<br>The learner should be able to: | **Suggested Learning Activities** | **Sample Assessment Strategies** |
|---|---|---|
| a. create isometric drawings of solids commonly found in the local environment to improve their understanding and communication of engineering designs. (k, u, s, v, gs) | a. Learners in groups, recount and discuss the principles of drawing isometric figures and then demonstrate their understanding by sketching objects from their environment, textbooks, internet, video clips and present to the class for feedback.<br>b. Learners in pairs, explore resources like textbooks, analyse isometric drawings and individually draw them to scale. They then display their work to the class | a. Observe the learners' collaborative skills as they create isometric drawings focusing on their ability to:<br>i) Actively listen and respect different perspectives when selecting appropriate foregrounds.<br>ii) Offer support to teammates when needed.<br>b. Engage learners in discussions as they develop isometric drawings, focusing on the:<br>i) Application of isometric projection principles.<br>ii) Effective use of instruments to create accurate and efficient drawings. |

| | | |
|---|---|---|
| | | c. Evaluate learners' drawings based on the following:<br>i) Paper lay-out.<br>ii) Overall neatness.<br>iii) Correct shape and direction<br>iv) Proper application of dimensions. |
| b. produce orthographic projections of solid objects within the environment to develop the ability to interpret 3D objects into 2D (k, u, s, v, gs) | a. Learners in groups explore the concept of orthographic projection (principles first and third angle projection), discuss and present their findings in class.<br>b. Learners engage in a think-pair-share activity to interpret and create orthographic views of objects from their environment in both first and third angle projections to scale. They display their work and participate in a gallery walk, where they critique each other's drawings. | a. Observe learners' ability to apply problem-solving skills in producing orthographic drawings, based on their ability to:<br>i) Use logical reasoning to interpret and apply principles.<br>ii) Explore alternative solutions when the initial approach proves ineffective.<br>iii) Collaborate with others to gather input, exchange ideas, and develop solutions.<br>b. Probe learners as they develop orthographic drawings with regard to:<br>i) Arrangement of views.<br>ii) Identification of faces/views.<br>iii) Proper application of dimensions.<br>c. Evaluate learners' orthographic drawings based on the:<br>i) Adherence to dimensioning standards.<br>ii) Clarity and readability of the drawings, including the quality of lines, and text.<br>iii) Correctness of the views presented. |

| | | |
|---|---|---|
| c. make models of solid objects using isometric and orthographic drawings for a deeper understanding of 3D aspect. (k, u, s, v/a, gs) | In groups, learners analyse drawings to study the patterns/formation of objects and brainstorm appropriate materials to create models. They then create models using locally available materials and present to classmates for constructive feedback. | a. Observe the learner's creativity in producing models, focusing on their ability to:<br>i) Work with others to interpret dimensions from isometric & orthographic drawings.<br>ii) Experiment with alternative methods for utilising the selected materials.<br>b. Probe learners as they make models to:<br>i) Establish suitable scales to be used.<br>ii) Identify suitable tools and materials.<br>c. Evaluate learners' models based on:<br>i) proportions.<br>ii) Consistency of model with the drawings. |

## TOPIC 2: Foundations and Floors

**Duration:** 20 Periods

**Competency:** The learner constructs foundations and floors for bungalow buildings within the environment by applying building principles and practices.

| Learning Outcome<br>The learner should be able to: | Suggested Learning Activities | Sample Assessment Strategies |
|---|---|---|
| a. design foundations and floors for bungalow buildings in the community to ensure stable and safe structures. (k, u, s, v/a, gs) | a. In a jig saw activity, learners in groups, explore extracts from textbooks or videos on **floors** (solid and suspended ground floors) and **foundations** (strip and pad) to identify the construction requirements and the materials used. They then present and critique each other's work in class.<br>b. Learners explore resources like internet, textbook extracts or video clips and individually create section drawings of foundations and floors to scale. They then display their drawings and critique each other. | a. Observe the learners' ability to own their learning when designing foundations and floors by observing their ability to:<br>i) Clearly express their understanding of the extracts and effectively communicate ideas to others.<br>ii) Work individually to make the floor and foundation sections.<br>b. Probe learners to highlight the design details of foundations and floors by focusing on:<br>i) Selecting appropriate scales.<br>ii) Organising details systematically.<br>c. Assess learners' section drawings with regard to:<br>i) Proper layout of the parts.<br>ii) Material symbols.<br>iii) Details mentioned. |

# SENIOR FIVE TERM 2

## TOPIC 3: Foundations and Floors

**Duration:** 36 Periods

**Competency:** The learner constructs foundations and floors for bungalow buildings within the environment by applying building principles and practices.

| Learning Outcome<br>The learner should be able to: | Suggested Learning Activities | Sample Assessment Strategies |
|---|---|---|
| a. practice construction of foundations and floors for bungalow buildings within their community, ensuring stability and safety of structures.<br>(k, u, s, v/a, gs) | a. In groups, learners analyse floor and foundation drawings from textbook extracts, brainstorm and discuss the process of construction before sharing their findings with the class.<br>b. Through guided discovery, learners in groups use internet, textbooks, video clips to analyse the materials, design appropriate formwork, proportion and mix concrete and create a prototype of a plain concrete foundation strip on a selected site within the school. Then in a gallery walk give constructive feedback.<br>c. Learners reflect their construction practice knowledge and skills to construct a foundation wall on the laid strip foundation. They explore textbooks, internet, video clips, or construction sites to prepare formwork and lay a solid floor slab. Then in a gallery walk give constructive feedback. | a. Observe learners' ability to apply problem-solving skills as they construct foundations and floors with regard to their ability to:<br>i) Analyse and adapt designs to meet specific site requirements.<br>ii) Distribute tasks to utilise team strength and manage time.<br>b. Probe learners during the construction of foundations and floors to ensure:<br>i) Adherence to safety standards.<br>ii) Proper use of material and tools.<br>iii) Compliance with construction processes.<br>c. Assess the learners' foundation and floor construction prototypes based on the:<br>i) Workmanship<br>ii) Organisation and arrangement of components. |

## TOPIC 4: Surface Development

**Duration:** 44 Periods

**Competency:** The learner designs patterns by unfolding surfaces to aid manufacturing of engineering products

| Learning Outcomes<br>The learner should be able to: | Suggested Learning Activities | Sample Assessment Strategies |
|---|---|---|
| a. produce true lengths and shapes of surfaces for making patterns. (k, u, s, gs) | a. Learners in groups explore textbooks to identify and study faces/edges of solids from orthographic views and real objects to establish the relationship between their lengths and angles of inclinations.<br>b. In pairs, the learners explore resources like textbooks or videos to determine: traces, true length, true shapes and true inclination angles to Vertical Plane / Horizontal Plane of edges/faces of objects using orthographic projection and make individual presentations to the class. | a. Observe learners critical thinking skills as they analyse objects to determine the lengths of edges or faces, focusing on their ability to:<br>i) Offer and receive constructive input to work.<br>ii) Explain how true lengths and shapes are determined and their role in the pattern.<br>b. Probe learners to:<br>i) Study the relationships between the actual edge lengths and their corresponding elevations in objects.<br>ii) Logically follow the steps required to determine traces, true lengths and true inclinations to the horizontal planes and vertical plane.<br>c. Assess the learners' drawings on:<br>i) Accuracy of true lengths and shapes.<br>ii) Correct positions of the traces and angles of inclination. |
| b. create patterns of transition pieces and multi-panel solid objects for | a. Learners work in groups to explore various shapes of transition pieces using pictures or video extracts. In a | a. Observe learner's creative skills as they make graphical patterns of |

| | | |
|---|---|---|
| making of engineering products. (k, u, s, v/a, gs) | jigsaw activity, they investigate their formation and real-life applications, present and discuss their findings in a plenary session.<br>b. Through guided discovery, learners create graphical patterns of transition pieces and multi-panel objects in orthographic projection. Then display the drawings for class critiquing.<br>c. Using a project-based approach, learners identify real-life objects or engineering products with transitioning shapes and panels. They design graphical patterns for these objects and construct models using local materials. They then present the models for constructive feedback. | objects, focusing on their ability to:<br>i) Analyse how different parts of the objects connect and transition smoothly.<br>ii) Draft, cut and assemble panels.<br>b. Converse with learners on the diverse methods of:<br>i) Determining the true lengths of predefined lines.<br>ii) Pattern formation.<br>c. Assess the learners' drawings and models focusing on:<br>i) Patterns.<br>ii) Accuracy of dimensions.<br>iii) Neatness.<br>iv) Consistency of model to drawing. |

# SENIOR FIVE TERM 3

## TOPIC 5: Walls

**Duration:** 80 Periods

**Competency:** The Learner illustrates wall details and applies building principles and practices to constructs walls that meet the requirements for bungalow houses.

| Learning Outcomes<br>The learner should be able to: | Suggested Learning Activities | Sample Assessment Strategies |
|---|---|---|
| a. create floor plans for bungalow houses that fulfill the client's preferences and requirements. (k, u, s, v/a, gs) | a. Learners in groups explore the school community, video/ picture extracts to study walls to establish their uses, requirements and wall openings (windows and doors). Groups present and defend their work before the rest of the class.<br>b. Using findings in a) above learners in a think pair share activity draw floor plans to scales of 1:50 and 1:100, for T or L-shaped bungalow buildings. They then produce elevations, sections, pictorial drawings and schedules of openings. | a. Observe learners' creative skills as they draw floor plans focusing on their ability to:<br>i) Design practical and functional layouts for given requirements.<br>ii) Manage space and incorporate unique design ideas.<br>b. Dialogue with learners as they produce scaled drawings based on:<br>i) Space maximisation.<br>ii) Layout of space basing on functionality.<br>c. Assess the learners' scaled drawings with regard to:<br>i) Proportionality of the rooms to their intended purpose and realistic design.<br>ii) Clarity of the drawing.<br>iii) Incorporation of windows, doors and ventilations. |
| b. construct brick walls for bungalow houses in the community to connect classroom learning with real-world application (k, u, s, v/a, gs) | a. Learners in pairs study sections of floor plans from text books/internet/video clips and use scales of 1:10 or 1:20 to make drawings of ½ & 1 brick thick walls to show the construction of stretcher and | a. Observe the learners' ability to collaborate skills while constructing brick walls focusing on: |

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|---|---|---|
| | header bonds at T- junctions and wall openings. They then display their work for critiquing in a gallery walk.<br>b. In a guided discovery, learners in groups visit a construction site to explore the process of brick laying at T- junctions and wall openings. Make reports, discuss and present in the class<br>c. Learners in groups erect brick walls in stretcher and header bond on the laid floor slab to demonstrate T- junctions and wall openings. They make a gallery walk and critique each other's work. | i) Sharing tasks such as mixing mortar, aligning bricks and checking levels.<br>ii) Working together to resolve challenges, like uneven surfaces or alignment issues.<br>b. Probe learners, as they lay bricks, to:<br>i) Observe Safety on site.<br>ii) Manage materials and tools<br>iii) Justify the arrangement of bricks.<br>iv) Finish joints<br>c. Assess the wall construction with regard to:<br>i) Consistency of bond patterns drawn to the model.<br>ii) Quality of joints finish<br>iii) Horizontal and vertical alignment of the wall.<br>iv) Neatness and quality of wall finishing. |

# SENIOR SIX TERM 1

## TOPIC 6: Vector Geometry

**Duration:** 40 Periods

**Competency:** The learner applies the principles of forces through practical exercises to maintain safe, efficient, and stable structures.

| Learning Outcome<br>The learner should be able to: | Suggested Learning Activities | Sample Assessment Strategies |
|---|---|---|
| a. analyse and resolve forces within structural systems to ensure stability and safety in engineering and construction projects. (k, u, s, gs) | a. Learners in groups, explore textbooks, video clips or the internet to analyse the forces (point and distributed loads) acting on real-life objects. They discuss and present their findings in class.<br>b. Learners work in groups to demonstrate the principle of equilibrium by applying loads on models of bridges, seesaws, signposts or roof trusses. They showcase the setup for others to critique.<br>c. In a think-pair-share activity, learners analyse textbooks to graphically and mathematically determine the resultant or equilibrant forces of concurrent and non-concurrent coplanar forces, then present their findings to the class.<br>d. Learners pair up and with the aid of text book extracts or video clips analyse loaded beams and frameworks to determine the reactions at the supports, shear force and the bending moments. The learners present their work to be critiqued and improved through a gallery walk. | a. Observe learners' problem-solving skills as they resolve forces in structural works focusing on their ability to:<br>i) Modify approaches when faced with new information or unexpected challenges. Use numbers and measurements accurately.<br>ii) Work with others to generate ideas.<br>b. Converse with learners as they resolve forces with regards to:<br>i) Real life application of forces in structural works.<br>ii) Maintaining systems (beams and structures) in Equilibrium.<br>c. Assess learners' drawings or calculations with regard to:<br>i) Drawing layout.<br>ii) Scales used.<br>iii) Bow's notation.<br>iv) Drawing titles.<br>v) Shear force diagram.<br>vi) Bending moment diagram.<br>vii) Vector diagram.<br>viii) Magnitude and force type in members. |

## TOPIC 7: Intersection of Solids

**Duration:** 40 Periods

**Competency:** Learner analyses and determines points of contact in intersecting solids using simulations to guide the manufacturing process.

| Learning Outcomes<br>The learner should be able to: | Suggested Learning Activities | Sample Assessment Strategies |
|---|---|---|
| a. plot points of intersection for intersecting objects to establish interaction between surfaces. (k, u, s, gs) | a. Learners work in groups to analyse intersecting objects from pictures or video extracts or surroundings. In a jigsaw activity, they investigate their formation in real-life. They then present and discuss their findings in a plenary session.<br>b. Through guided discovery, learners work in pairs to produce curves or lines of intersection between surfaces (using textbooks, internet, video clips) and present as individuals.<br>c. Using a project-based approach, learners identify real-life objects or engineering products with intersecting surfaces and make models using local materials. Learners exhibit and critique their models. | a. Observe learners critical thinking skills as they produce curves or lines of intersection between surfaces, focusing on their ability to:<br>i) Explore different methods for determining points.<br>ii) Integrate diverse ideas into a cohesive and accurate drawing.<br>b. Converse with learners about the diverse methods of:<br>i) Determining the face and edges to manipulate to obtain points of intersection.<br>ii) Joining the surfaces.<br>c. Assess learners' drawings with regard to the:<br>i) Correct curve or lines of intersection.<br>ii) Accuracy of dimensions.<br>i) Neatness. |

# SENIOR SIX TERM 2

## TOPIC 8: Roofs

**Duration:** 80 Periods

**Competency:** The Learner illustrates gable and hipped roof details and applies roofing principles and techniques to make roof models that meet the requirements for bungalow houses.

| Learning Outcomes<br>The learner should be able to: | Suggested Learning Activities | Sample Assessment Strategies |
|---|---|---|
| a. create gabled and hipped roofs for bungalow houses that fulfill the client's preferences and requirements. (k, u, s, v/a, gs) | a. Learners in groups explore the school community, video/ picture extracts to study roofs, make sketches of roof structures and label components. They then discuss and present<br>b. Learners in a think pair share activity refer to the already drawn floor plans to generate views (elevations and sections) to scale and make free-hand pictorial sketches. They then display their drawings for critiquing. | a. Observe learners' creative skills as they draw gable and hipped roofs based on their ability to:<br>i) Generate unique and original designs for gable and hipped roofs.<br>ii) Adapt designs to account for functional or structural requirements.<br>iii) Modify designs based on feedback or specific constraints.<br>b. Dialogue with learners as they use geometrical concepts to bring out the design features of the roof projections on the:<br>i) Functional aspects of roof design.<br>ii) Use of geometrical elements in presenting roof drawings.<br>iii) Choice of appropriate roofing material and joints<br>c. Assess the drawing with regard to:<br>i) Scale used.<br>ii) Overall presentation of views.<br>iii) Labelling and annotation of roof members.<br>iv) Joints used for roofing.<br>v) Pitch of the roof.<br>vi) Arrangement of members. |

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| b. make prototypes of gabled and hipped roofs for bungalow buildings in the community to simulate real life construction. (k, u, s, v/a, gs) | a. Learners visit a construction site or explore video/picture extracts to analyse roof construction. In groups, they brainstorm the process of constructing gabled and hipped roofs for bungalow buildings in the community.<br>b. In groups learners interpret the roof drawings from resources like, internet, video clips, textbooks or pictures and develop prototypes of gable and hipped roof. They display their work to be assessed through a gallery walk. | a. Observe the learners' collaboration skills when translating drawings to real-life objects, focusing on their ability to:<br>i) effectively work as a team to construct the prototype.<br>ii) try out innovative alternatives when making the prototypes.<br>b. Converse with learners as they make prototypes for roofs with regard to the:<br>i) Choice of materials, tools and equipment.<br>ii) Pattern formation.<br>iii) Process to follow when making prototypes.<br>c. Assess learners' roof prototypes with regard to the:<br>i) Correct presentation of gabled and hipped roofs.<br>ii) Stability and sturdiness of the roof prototype.<br>iii) Proportionality and correct use of scales.<br>iv) Functionality of the prototype. |

# SENIOR SIX TERM 3

## TOPIC 10: Building Drawing

**Duration:** 48 Periods

**Competency**: The learner communicates client's intentions to the builder by creating architectural plans for construction purposes.

| Learning Outcomes<br>The learner should be able to: | Suggested Learning Activities | Sample Assessment Strategies |
|---|---|---|
| a. prepare working drawings and models for the construction of buildings in the community. (k, u, s, v/a, gs) | a. Through project-based learning, learners work in groups to explore architectural drawings and designs from textbook extracts of L- or T-shaped bungalow buildings with gabled, hipped or combination roofs. They present their designs in class for critiquing.<br>b. Learners refine their work and produce complete working drawings and models of their building designs to scale. They then display their work in a gallery setting in the classroom for others to critique. | a. Observe learners' creativity in designing and modelling bungalow buildings focusing on their ability to:<br>i) Analyse community architectural needs.<br>ii) Adapt design to suit particular situations.<br>b. Probe learners as they prepare working drawings and models for buildings with regard to:<br>i) Interpretation & usage of scales and preparation of schedules.<br>ii) Choice of materials, tools, equipment and steps to follow when making models.<br>c. Assess learners' working drawings and models with regard to the:<br>i) Alignment of the drawings with architectural drawing conventions.<br>ii) Presentation of all required details (Ground plan, Section, Elevations, Site layout, Window/door schedules).<br>iii) Precision of dimensions and proportionality.<br>iv) Neatness and readability. |

# GEOMETRICAL AND MECHANICAL CONSTRUCTION SYLLABUS

## SENIOR FIVE TERM 1

### TOPIC 1: Machine Drawing

**Duration:** 60 Periods

**Competency:** The learner uses drawing tools and techniques to create detailed drawings and models that show how different machine parts fit together and work.

| **Learning Outcomes** The learner should be able to: | **Suggested Learning Activities** | **Sample Assessment Strategy** |
|---|---|---|
| a. create isometric drawings of solids<br>b. commonly found in the local environment to improve their understanding and communication of engineering designs. (k, u, s, v, gs) | a. In a Think-Pair-Share activity, learners identify objects within their environment and make freehand sketches of those objects. They display their sketches and critique each other.<br>b. In a guided discovery activity, learners pair up to explore resources like textbooks to produce isometric drawings of real-life objects to scale and individually present their drawings. | a. Observe the learners' collaborative skills as they create isometric drawings focusing on their ability to:<br>i) Actively listen and respect different perspectives when selecting appropriate foregrounds.<br>ii) Offer support to teammates when needed.<br>iii) Take responsibility of personal learning.<br>b. Engage learners in discussions as they develop isometric drawings, focusing on the:<br>i) Application of isometric projection principles.<br>ii) Effective use of instruments to create accurate and efficient drawings.<br>c. Evaluate learners' drawings basing on the following:<br>i) Overall neatness.<br>ii) Correct shape and direction<br>iii) Drawing paper lay-out |
| c. produce orthographic views of solid objects present | a. Learners in groups explore the concept of orthographic projection (principles first and third angle projection) from | a. Observe learners' ability to apply problem-solving skills in producing orthographic |

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| within the environment to clearly communicate their shape, size and details. (v/a, u, s, gs) | textbooks or video clips or internet, discuss and present their findings in class.<br>b. Learners engage in a think-pair-share activity to interpret and create orthographic views of objects (from their environment, internet, textbooks, video clips) in both first and third angle projections to scale. They display their work and participate in a gallery walk, where they critique each other's drawings. | drawings, based on their ability to:<br>i) Use logical reasoning to interpret and apply principles.<br>ii) Explore alternative solutions when the initial approach proves ineffective.<br>iii) Collaborate with others to gather input, exchange ideas, and develop solutions.<br>b. Probe learners as they develop orthographic drawings with regard to:<br>i) Arrangement of views.<br>ii) Identification of faces/views.<br>iii) Proper application of dimensions.<br>c. Evaluate learners' orthographic drawings based on the:<br>i) Adherence to dimensioning standards.<br>ii) Clarity and readability of the drawings, including the quality of lines, text, and annotations.<br>iii) Correctness of the views presented. |
| d. create physical models of solid objects based on drawn isometric and orthographic drawings for a deeper understanding of 3D aspect. (v/a, u, s, gs) | a. In groups, learners analyse their drawings to study the patterns/formation of objects and brainstorm appropriate materials to create models.<br>b. Learners create models using locally available materials and present to classmates for constructive feedback. | a. Observe the learners' problem-solving skills as they produce models of solid objects based on isometric and orthographic drawings, focusing on their ability to:<br>i) Identify and resolve any challenges encountered during the modelling.<br>ii) Experiment with alternative methods for utilising the selected materials.<br>b. Probe learners as they make models with regard to:<br>i) Scale to be used. |

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| | | ii) Identification of suitable tools and materials.<br>c. Evaluate learners' models based on:<br>i) Workmanship.<br>ii) Consistency of model with the drawings. |
| e. design and draw various mechanical fasteners within their environment to understand the importance of strong and effective connections in mechanical systems. (v/a, u, s, gs) | a. In a jigsaw activity, Learners, in groups, explore resources such as textbook extracts, video clips, and realia to identify and describe various mechanical fasteners. (*screws, bolts, studs, nuts, springs, locking devices*) and their operation. They discuss and share their findings with the class.<br>b. Learners in a think-pair-share activity, reflect on the principles of orthographic and isometric projection to develop working drawings for mechanical fasteners. They present their findings.<br>c. Learners in a project-based activity explore resources like internet, textbooks, realia, video clips to create and present models or prototypes of mechanical fasteners and provide constructive feedback to one another. | a. Observe learners' problem-solving skills as they interact with each other to relate particular mechanical fasteners to their functions by:<br>i) Paying close attention to the specifications and requirements of fasteners to ensure they meet the intended purpose.<br>ii) Choosing the most appropriate fasteners based on their properties and the requirements of the task.<br>b. Probe learners to ensure the use of principles when producing engineering drawings, focusing on:<br>i) Conventions or standards.<br>ii) Projection methods.<br>iii) Sectioning principles.<br>c. Evaluate learners' working drawings and prototypes based on the:<br>i) Accuracy of dimensions, proportions, and scales.<br>ii) Clarity and readability of the drawings.<br>iii) Correctness of the views presented.<br>iv) Consistency of the prototypes to the drawings. |

# SENIOR FIVE TERM 2

## TOPIC 2: Machine Drawing

**Duration:** 80 Periods

**Competency:** The learner uses drawing tools and techniques to create detailed drawings and models that show how different machine parts fit together and work.

| **Learning Outcomes** The learner should be able to: | **Suggested Learning Activities** | **Sample Assessment Strategy** |
|---|---|---|
| a. use different dimensioning styles according to British Standards 308-part 2 for defining the geometry of features. (k, u) | a. In a jigsaw activity, learners in groups explore resources such as textbook extracts and video clips to get exposure to various dimensioning techniques used on engineering drawings. They discuss and present their findings.<br>b. In a think-pair-share activity, learners explore textbooks to produce dimensioned engineering drawings using standards. They individually present their drawings to the class for feedback. | a. Observe learners' creative skills as they use different dimensioning styles on engineering drawings from resources focusing on their ability to:<br>i) Appropriately place dimensions at different positions of the drawing.<br>ii) Balance the need for accuracy with the challenge of fitting measurements into a clear, organized layout<br>iii) Offer support to teammates when needed.<br>b. Probe learners to identify ways of dimensioning engineering drawings focusing on:<br>i) Dimensioning types and standards.<br>ii) Real world application of dimensioning styles.<br>iii) Consistency.<br>c. Evaluate learners' engineering drawings based on:<br>i) Accuracy and precision.<br>ii) Clarity and legibility. |
| b. indicate and interpret the tolerance dimensions according to ISO 45001 recommendations for defining allowable | a. In a guided discovery activity, learners in groups explore resources such as textbook extracts, video clips and realia to identify elements of interchangeable systems and their application in mechanical assemblies. | a. Observe learners' ability to apply problem-solving skills interact with others to identify elements of interchangeable systems in engineering drawings from various resources by:<br>i) Actively listening to understand elements of interchangeable systems. |

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| variations. (v/a, u, s, gs) | b. In a think-pair-share activity, learners produce dimensioned engineering drawings (with clear elements of interchangeable systems). | ii) Offering and receiving constructive feedback.<br>b. Probe learners on:<br>i) Significance of tolerance.<br>ii) Application of dimensioning, limits and fits in engineering drawing focusing on.<br>c. Evaluate learners' engineering drawings based on:<br>i) Accuracy and precision.<br>ii) Clarity and legibility.<br>iii) Consistency in application. |
| c. construct orthographic views of machine parts of mechanical systems to communicate complex engineering designs. (k, u, s) | a. Learners individually use textbooks, internet, video clips to study, interpret and create orthographic views (including sectional views) of machine parts or simple common machines in their environment in both first and third angle projections, applying suitable scales. They display their work and participate in a gallery walk, where they critique each other's drawings. | a. Observe learners' ability to apply problem-solving skills in producing orthographic drawings of machines, based on their ability to:<br>i) Use logical reasoning to interpret and apply principles in creating the drawing.<br>ii) Explore alternative solutions when the initial approach proves ineffective.<br>iii) Collaborate with others to gather input, exchange ideas, and develop solutions.<br>b. Probe learners in discussions to guide them to develop orthographic drawings with regard to the:<br>i) Placement of elevations based on their viewpoint.<br>ii) Use of various projection methods.<br>iii) Proper application of dimensions.<br>c. Evaluate learners' orthographic drawings based on the:<br>i) Accuracy of dimensions, proportions, and scales.<br>ii) Adherence to dimensioning standards.<br>iii) Clarity and readability of the drawings correctness of the views presented. |

# SENIOR FIVE TERM 3

## TOPIC 3: Power Transmission Systems

**Duration:** 36 Periods

**Competency:** The learner designs, installs, maintains and troubleshoots systems by engaging in hands-on projects, simulations, and practical exercises.

| Learning Outcomes<br>The learner should be able to: | Suggested Learning Activities | Sample Assessment Strategy |
|---|---|---|
| a. describe mechanical structures and operations of power transmission elements, gaining essential knowledge of how different parts of machines work together to transmit power. | a. In a jigsaw activity, learners explore resources such as textbook extracts, video clips and realia to identify and understand power transmission elements (for example, shafts, bearings, gears, cams, couplings, clutches, pulleys, belts and chains). They discuss and share key points with the class.<br><br>b. In a guided discovery activity, learners in groups use textbooks or realia to explore the operation of power transmission elements such as shafts, bearings, pulleys, couplings and gears). They make own notes and later present their finding to the class | a. Observe learners' problem-solving skills as they explore resources to comprehend power transmission elements for their ability to:<br>i) Identify the key components of power transmission systems (e.g., gears, belts, shafts).<br>ii) Analyse the relationships between different components (e.g., how a pulley affects torque or speed).<br>iii) Notice small but critical details in diagrams or system schematics<br>b. Probe learners to**:**<br>i) Explain the components of power transmission systems, emphasising their key characteristics.<br>ii) Outline the functions of various types of power transmission elements.<br>iii) Propose alternative ways to solve transmission-related challenges<br>c. Evaluate learners' understanding of power transmission elements using the following criteria:<br>i) Precision in describing the structure and function of elements such as shafts, bearings, pulleys, couplings, and gears. |

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| | | ii) Use of technical terminology and inclusion of relevant details.<br>iii) Clear and coherent explanations of each element's role in the power transmission system |
| b. draw elements of power transmission systems to gain clear visual understanding of how different components work together to transmit power. (k, u, s) | In a guided discovery activity, learners work in groups to explore various resources, including technical diagrams, cutaway views of machines, textbook excerpts, online materials, or realia.<br>Each group selects a specific power transmission element to study in detail (e.g., bearings). They analyze its shape, structure, and function within the system, determine appropriate scales, and create detailed drawings of individual parts and their assemblies. They display their drawings for constructive feedback. | a. Observe learners' critical thinking skills as they study and draw elements of power transmission systems for their ability to:<br>i) Break down complex components into their individual parts (e.g., identifying gear teeth, shafts, or bearings in assemblies).<br>ii) Examine the relationships between different components within the system (e.g., how the shaft connects to the pulley)<br>b. Probe learners to:<br>i) Explain how a chosen element contributes to its overall power transmission system<br>ii) Analyse how the specific features of an element are crucial for its function<br>iii) Analyse how the shape of a given element (e.g., circular bearings or toothed gears) enhance its performance<br>iv) Tell why a chosen element is preferred over other components in certain applications<br>c. Assess learners' drawings based on the following criteria:<br>i) Clarity of illustrations.<br>ii) Relevant parts of the element included (e.g., shafts, pins, or teeth for gears).<br>iii) Necessary labels, annotations and dimensions. |

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|---|---|---|
| c. create models or prototypes that demonstrate power transmission in systems, to enhance their understanding of how mechanical components work together to transmit power. (a/v, k, u, s, gs) | a. Learners engage in a project-based activity where they explore different challenges that require solutions through power transmission systems.<br>b. Learners discuss and decide on the type of model or prototype (e.g., simple gear train, pulley system or chain drive) that can effectively address the identified problem.<br>c. Learners then, brainstorm and plan how they will demonstrate the transfer of power in their chosen model and also decide on the materials to be used, such as cardboard, string, small motors, 3D-printed parts or blocks pieces.<br>d. Each learner documents the resources utilised, outlines the process they followed and presents graphical representations of their project in a portfolio.<br>e. Finally, learners display their finished products in an exhibition and participate in a critique session, providing constructive feedback on each other's work | a. Observe learners' creativity as they Create models or prototypes that demonstrate power transmission for their ability to:<br>i) Decide appropriate models or prototypes that can solve the identified problem.<br>ii) Use graphical representations to translate abstract concepts into tangible drawings of the model or prototype<br>b. Probe learners in a discussion to explain the application of elements of power transmission systems focusing on the:<br>i) Relationship between the drawings and model or prototype of the elements of power transmission systems.<br>ii) Choice of materials, tools and processes.<br>iii) Environmental and safety guidelines involved.<br>c. Assess learners' models or prototypes based on the following criteria:<br>i) Proportionality.<br>ii) Craftsmanship.<br>iii) Functionality. |
| d. track and plot paths taken by component parts of systems to address real life situations. | In a guided discovery activity, learners in groups explore resources such as textbook extracts, video clips, CAD simulations or realia to explore and draw paths taken by moving | a. Observe learners critical thinking skills as they Track and plot paths taken by component parts of systems for their ability to:<br>i) Observe and evaluate the individual components and how they interact. |

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| | points on mechanical systems (cycloids, helix, involutes, spirals, etc). Learners in groups present findings to class and individually display drawings for critiquing. | ii) Identify relevant components and understand their specific roles within the larger system.<br>iii) Assess the paths taken by the components and interpret their significance within the system.<br>b. Dialogue with learners to establish:<br>i) Whether the drawings created represent actual motions in mechanical systems in real life<br>ii) The role of parameters like velocity, angle and rotation in shaping the paths in systems.<br>c. Assess learners' drawings based on the following criteria:<br>i) Neat, clear and precise graphical representations.<br>ii) Path shapes are consistent with the expected real-world equivalents.<br>iii) Symbols and conventions. |

# SENIOR SIX TERM 1

## TOPIC 4: Power Transmission Systems

**Duration:** 48 Periods

**Competency:** The learner designs, installs, maintains and troubleshoots systems by engaging in hands-on projects, simulations, and practical exercises.

| Learning Outcome<br>The learner should be able to: | Suggested Learning Activities | Sample Assessment Strategy |
|---|---|---|
| a. create drawings and models that illustrate motions generated by link-mechanisms to deepen understanding of mechanical movements and system operations. | a. In a guided discovery activity, learners collaborate in groups to explore resources such as textbook excerpts, video clips, CAD simulations, or realia to understand how paths are generated by points on moving mechanical systems (loci of mechanisms).<br>b. They discuss their findings and create line sketches of machines, focusing on the specific parts that illustrate how the point generates the path. They then document the process leading to the path and present their findings to the class.<br>c. Using identified scales, learners individually create drawings of paths generated by points on various machines previously explored. They exchange ideas, share experiences, and continuously review their work as they advance to more complex machine paths.<br>d. In groups, learners identify a problem in their environment that can be addressed using motions | a. Observe learners' critical thinking skills as they Create drawings and models that illustrate motions generated by linked mechanisms for their ability to:<br>i) Analyse how linked mechanisms function and identify the components responsible for generating specific motions.<br>ii) Demonstrate understanding of how the movement of one part influences the motion of another within a linked mechanism<br>b. Probe learners to:<br>i) Understand the components of a mechanical system that can create the desired motion.<br>ii) Explain how the motion will be transferred between components<br>iii) Possible modifications in mechanical systems. |

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| | generated by linked mechanisms. They design and showcase models or prototypes of mechanical systems (loci of mechanisms) as part of a project-based activity. Finally, they critique each other's work and provide constructive feedback. | c. Assess learners' drawings based on the following criteria:<br>i) Correct Representation of Motion.<br>ii) Symbols and conventions.<br>iii) Proportions and ScaleLine types.<br>iv) Loci Accuracy. |

## TOPIC 5: Surface Development

**Duration:** 32 Periods

**Competency**: The learner designs patterns by unfolding surfaces to aid manufacturing of engineering products.

| **Learning Outcome**<br>The learner should be able to: | **Suggested Learning Activities** | **Sample Assessment Strategy** |
|---|---|---|
| a. produce true lengths and shapes of surfaces for making patterns. | a. Learners work in groups to identify and study faces/edges of solids from orthographic views and real objects to establish the relationship between their lengths and angles of inclinations. They discuss and present findings.<br>b. In pairs, the learners explore resources like textbooks or videos to determine traces, true length, true shapes and true inclination angles to Vertical Plane / Horizontal Plane of edges/faces of objects using orthographic projection and make individual presentations to the class. | a. Observe learners critical thinking skills as they analyse objects to determine the lengths of edges or faces, focusing on their ability to:<br>i) Offer and receive constructive input to work.<br>ii) Explain how true lengths and shapes are determined and their role in the pattern.<br>b. Probe learners to:<br>i) Study the relationships between the actual edge lengths and their corresponding elevations in objects.<br>ii) Logically follow the steps required to determine traces, true lengths and true inclinations to the horizontal planes and vertical plane.<br>c. Assess the learners' drawings on:<br>i) Accuracy of true lengths and shapes.<br>ii) Correct positions of the traces and angles of inclination. |

# SENIOR SIX TERM 2

## TOPIC 6: Surface Development

**Duration:** 26 Periods

**Competency:** The learner designs patterns by unfolding surfaces to aid manufacturing of engineering products.

| **Learning Outcome**<br>The learner should be able to: | **Suggested Learning Activities** | **Sample Assessment Strategy** |
|---|---|---|
| a. create patterns of transition pieces and multi-panel solid objects for making of engineering products. | a. Learners work in groups to explore various shapes of transition pieces using pictures or video extracts. In a jigsaw activity, they investigate their formation and real-life applications, present and discuss their findings in a plenary session.<br>b. Through guided discovery, learners create graphical patterns of transition pieces and multi-panel objects in orthographic projection. Then display the drawings for class critiquing.<br>c. Using a project-based approach, learners identify real-life objects or engineering products with transitioning shapes and panels. They design graphical patterns for these objects and construct models using local materials. They then present the models for constructive feedback. | a. Observe learner's creative skills as they make graphical patterns of objects, focusing on their ability to:<br>i) Analyse how different parts of the objects connect and transition smoothly.<br>ii) Draft, cut and assemble panels.<br>b. Converse with learners on the diverse methods of:<br>i) Determining the true lengths of predefined lines.<br>ii) Pattern formation.<br>c. Assess the learners' drawings and models focusing on:<br>i) Patterns.<br>ii) Accuracy of dimensions.<br>iii) Neatness.<br>iv) Consistency of model to drawing. |

## TOPIC 7: Intersection of Solids

**Duration:** 54 Periods

**Competency**: The learner analyses and determines points of contact in intersecting solids using simulations to guide the manufacturing process.

| **Learning Outcome**<br>The learner should be able to: | **Suggested Learning Activities** | **Sample Assessment Strategy** |
|---|---|---|
| a. plot points of intersection for intersecting objects to establish interaction between surfaces. (k, u, s, gs) | a. Learners work in groups to analyse intersecting objects from pictures or video extracts or surroundings. In a jigsaw activity, they investigate their formation and real-life applications, and present and discuss their findings in a plenary session.<br>b. Through guided discovery, learners work in pairs to produce curves or lines of intersection between surfaces (using textbooks, internet, video clips) and present as individuals.<br>c. Using a project-based approach, learners identify real-life objects or engineering products with intersecting surfaces and make models using local materials. Learners exhibit and critique their models. | a. Observe learners critical thinking skills as they produce curves or lines of intersection between surfaces, focusing on their ability to:<br>i) Explore different methods for determining points.<br>ii) Integrate diverse ideas into a cohesive and accurate drawing.<br>b. Converse with learners about the diverse methods of:<br>i) Determining the face and edges to manipulate to obtain points of intersection.<br>ii) Joining the surfaces.<br>c. Assess learners' drawings with regard to the:<br>i) Correct curve or lines of intersection.<br>ii) Accuracy of dimensions.<br>iii) Neatness. |

# SENIOR SIX TERM 3

## TOPIC 8: Vector Geometry

**Duration:** 48 Periods

**Topic competency:** The learner applies the principles of forces through practical exercises to maintain safe, efficient, and stable structures.

| **Learning Outcome**<br>*The learner should be able to:* | **Suggested Learning Activities** | **Sample Assessment Strategies** |
|---|---|---|
| a. analyse and resolve forces within structural systems to ensure stability and safety in engineering and construction projects. | a. Learners work in groups to explore textbooks, video clips or the internet to analyse forces (point and distributed loads) acting on real-life objects. They then discuss and present their findings in class.<br>b. Learners work in groups to demonstrate the principle of equilibrium by applying loads on models of bridges, seesaws, signposts or roof trusses. They showcase the setup for others to critique.<br>c. Learners, in a think-pair-share activity, explore textbooks to determine (graphically and by calculation) the resultant or equilibrant of a given system of forces (concurrent and non-concurrent coplanar forces), then present to the class.<br>d. Learners pair up and with the aid of text book extracts or video clips analyse loaded beams and frameworks to determine the reactions at the supports, shear force and bending moments. They then present their work for critiquing and improvement in a gallery walk. | **a.** Observe learners' problem-solving skills as they resolve forces in structural works focusing on their ability to:<br>i) Modify approaches when faced with new information or unexpected challenges. Use numbers and measurement accurately.<br>ii) Work with others to generate ideas.<br>b. Converse with learners as they resolve forces with regards to:<br>i) Real life application of forces in structural works.<br>ii) Maintaining systems(beams and structures) in Equilibrium.<br>c. Assess learners' drawings or calculations with regard to:<br>i) Drawing layout.<br>ii) Scales used.<br>iii) Bow's notation.<br>iv) Drawing titles.<br>v) Shear force diagram.<br>vi) Bending moment diagram.<br>vii) Vector diagram.<br>viii) Magnitude and force type in members. |

# 3.0 ASSESSMENT

## 3.1 Assessing Technical drawing

This Advanced Secondary Curriculum sets new expectations for learning, with a shift from Objectives to Learning Outcomes that focus mainly on the application of knowledge and deeper learning that leads to the acquisition of skills. These Learning Outcomes require a different approach to assessment. The "Learning Outcomes" in the syllabi are set out in terms of Knowledge, Understanding, Skills, Values and Attitudes. This is what is referred to by the letters k, u, s v & a.

It is not possible to assess values and attitudes in the same way as knowledge, understanding, and skills because they are more personal and variable, and are long-term aspirations. This does not mean that values and attitudes are not important or cannot be assessed. They too can be assessed but not easily done through tests and examinations. Values and attitudes can be assessed over a period of time through observing and having interactions with the learner.

To assess knowledge and its application, understanding, and skills, we need to look for different things. Knowledge can be assessed to some extent through written tests, but the assessment of skills, application of what is learnt, and deeper understanding requires different approaches. Because of this, the role of the teacher in assessment becomes much more important. This section focuses on knowledge, understanding, and skills.

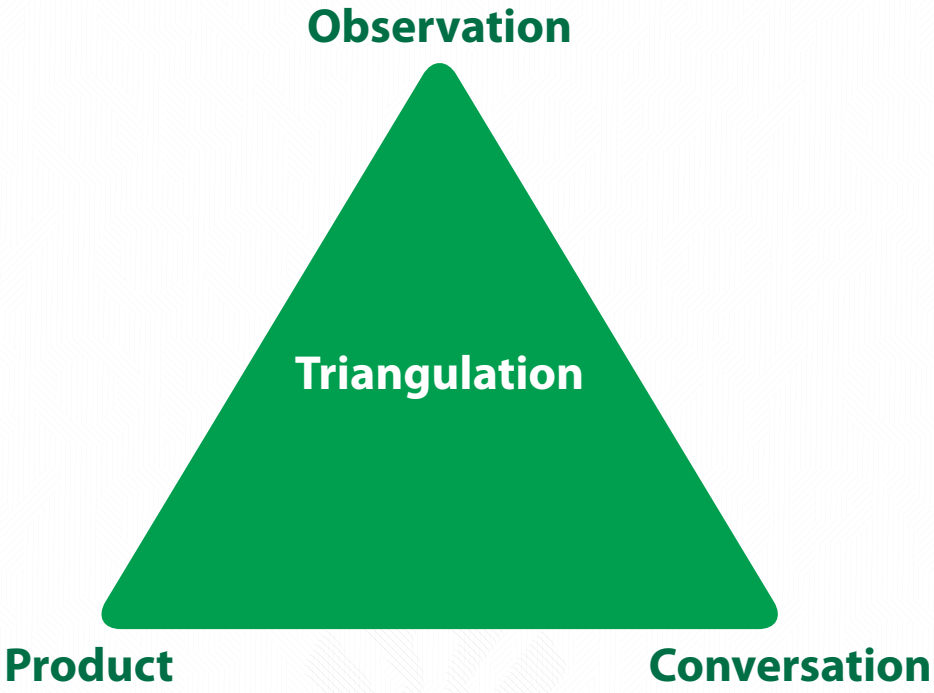
## 3.2 Formative Assessment

In this curriculum, the teacher's role in assessment is not only to write tests for the learner but also to make a professional judgment about the learner's learning during the teaching and learning process. The professional judgment is about how far the learner achieves the Learning Outcomes that are set out in this syllabus. To make these judgments the teacher needs to look at how well the learner is performing in terms of each Learning Outcome.

The formative assessment opportunities occur in three forms. They can be done through:

a. **Observation** – watching learners working (good for assessing skills, values and attitudes)
b. **Conversation** – asking questions and talking to learners (good for assessing knowledge and understanding)
c. **Product** – appraising the learner's work (writing, report, translation, calculation, presentation, map, diagram, model, drawing, painting etc). In this context, a "product" is seen as something physical and permanent that the teacher can keep and look at.

When all three are used, the information from any one can be checked against the other two forms of assessment opportunity (e.g. evidence from "observation" can be checked against evidence from "conversation" and "product"). This is often referred to as "triangulation




## 3.3 Assessing Generic Skills

The Generic Skills have been built into the syllabuses and are part of the Learning Outcomes. It is therefore not necessary to assess them separately. It is the increasingly complex context of the subject content that provides progression in the Generic Skills and so they are assessed as part of the subject Learning Outcomes. Assessing generic skills is done with the help of an observation checklist and scoring rubric.

## 3.4 Assessing Values/Attitudes

It is not possible to assess values and attitudes in the same way as knowledge, understanding and skills because they are more personal and variable and are long-term aspirations. This does not mean that attitudes are not important. It means that we must value things that we cannot easily assess through tests and examination. However, values and attitudes can be assessed over a long period of time through observing and interactions.

## 3.5 Assessment of Project-based Learning

Project-based learning is a teaching method in which learners or participants gain knowledge and skills by engaging for an extended period of time to investigate and respond to an authentic challenge. The task must have a driving question and it involves sustained inquiry.

Project-based learning is assessed using a rubric and an observation checklist.

## 3.6 Examinations

There will be only one school based summative assessment at the end of the year. There will no longer be examinations or tests set at the beginning and end of every term. Instead, there will be a summing up of on-going teacher assessments made in the context of learning through end of topic scenario-based tasks (Activities of Integration). The learners will also be subjected to the end of cycle assessment for certification.

## 3.6 Record Keeping

In competency-based learning, accurate and comprehensive record keeping is crucial to track learners' progress and achievements. Therefore, the teacher and school must keep accurate records about learners' achievement.

Various assessment tools and strategies are employed to capture learners' demonstration of abilities and achievements, including observation checklists, rubrics, and scoring grids. These tools provide a holistic picture of learners' strengths, weaknesses, and areas for improvement.

The collected data and evidence from these assessments are correctly recorded and maintained in learners' files, portfolios and anecdotal notes.

# Glossary of Key Terms

| Term | Definition |
|---|---|
| **competency curriculum** | One in which learners develop the ability to apply their learning with confidence in a range of situations. |
| **differentiation** | The design or adaptation of learning experiences to suit an individual learner's needs, strengths, preferences, and abilities. |
| **formative assessment** | The process of judging a learner's performance, by interpreting the responses to tasks, in order to gauge progress and inform subsequent learning steps. |
| **generic skills** | Skills which are deployed in all subjects, and which enhance the learning of those subjects. These skills also equip young people for work and for life. |
| **inclusion** | An approach to planning learning experiences which allows each student to feel confident, respected and safe and equipped to learn at his or her full potential. |
| **learning outcome** | A statement which specifies what the learner should know, understand, or be able to do within a particular aspect of a subject. |
| **process skill** | A capability acquired by following the programme of study in a particular Learning Area; enables a learner to apply the knowledge and understanding of the Learning Area. |
| **sample assessment activity** | An activity that allows a learner to show the ex-tent to which s/he has achieved the Learning Outcomes. This is usually part of the normal teaching and learning process, and not something extra at the end of a topic. |
| **suggested learning activity** | An aspect of the normal teaching and learning process that will enable a formative assessment to be made. |

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ISBN 978-9970-675-42-5