THE REPUBLIC OF UGANDA
Ministry of Education and Sports

# ADVANCED SECONDARY CURRICULUM

# METAL WORK SYLLABUS

NCDC
NATIONAL CURRICULUM DEVELOPMENT CENTRE
2025

ADVANCED SECONDARY
CURRICULUM

# METAL WORK
# SYLLABUS

2025




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

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# Contents

# 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 Metalwork syllabus provides technical skills and vocational training for learners, enhancing their employability and enabling them to pursue careers in sectors such as tool making, welding, fabrication and foundry work. It promotes the acquisition of Higher-order Thinking Skills (HOTS) such as inquiry, creativity and innovation, decision-making, critical thinking and problem-solving. It calls for the use of learner-centred pedagogies with hands-on experience by the learners in real-life situations, while acknowledging different learner abilities and learning styles.

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

Hon. Janet Kataaha Museveni

**First Lady and Minister of Education & Sports**

# ACKNOWLEDGEMENTS

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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 Adapted A 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.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 and 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 Metalwork 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 Metalwork 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 Education 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:**

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**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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**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 learners 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 speciality. They are infused in the different 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 base themselves on these values as citizens of Uganda. These values are derived from the Uganda National Ethics and Values Policy of 2013. They are:

i) Respect for humanity and the environment
ii) Honesty, upholding and defending 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 not taught directly in lessons, nor are they assessed by pen and paper. However, they are incorporated into some learning outcomes and are developed as learner's progress.

## 1.7 Information and Communication Technology (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 part and parcel of learning in the 21st century. In Metalwork, the learner will be tasked to identify a community problem. Using a needs analysis, the learner will sketch, design and fabricate a product with metalworking skills to address the identified needs. All stages of the process will be documented in a portfolio, which will be subjected to assessment. This project will connect theoretical knowledge to practical tasks, promote academic research, and keep learners engaged and motivated, and not only prepared for academic success but also for real-life challenges. Teachers are encouraged to guide learners through engaging in projects that can easily be linked to what is happening in their local environment.

## 1.9 The Aims of Secondary Education

The aims of secondary education in Uganda are to:

i) Instil 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 the emerging needs of society and the economy;

v) Provide up-to-date and comprehensive knowledge about the theoretical and practical aspects of innovative production, modern management methods in the field of commerce and industry, and their application in the context of the 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 the 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 the acquired skills in solving problems of the community, and to develop a strong sense of constructive and beneficial belonging to that community;

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

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

## 1.10 Aims of the Advanced Secondary Curriculum

i) To adopt a competency-based learning approach.
ii) To develop holistic education for personal and national development based on clear shared values.
iii) To develop key skills which are essential to work and life and promote lifelong learning.
iv) To adopt an integrated approach to learning that develops the ability of learners to apply learning.
v) To improve on assessments by incorporating school-based assessment into the end-of-cycle assessment.
vi) To emphasise the learner's participation through engagement with the community.
vii) To prepare learners for further education.

## 1.11 Rationale for Teaching Metalwork at A-Level

The Advanced level Metalwork curriculum aims to develop a learner with:

i) Hands-on that can be applied in everyday life. This includes; cutting, shaping, joining and finishing techniques.
ii) Deep understanding of the various methods used in metalwork. This includes; casting, welding and forging.
iii) Safety awareness in all metalwork activities to prevent accidents and ensure safe working environments.
iv) Design and innovation skills required in metalwork structures and products while emphasising creativity, functionality and technical precision.
v) Metalwork skills that involve overcoming challenges and problem-solving. Whether it's choosing the right materials, troubleshooting an issue, or optimizing a design and develop essential critical thinking skills.
vi) Skills and knowledge for pursuing further studies in engineering and design, and for employment in job market that require metalworking expertise.

## 1.12 Subject Overview

The Metalwork areas of study have been re-organised within the syllabus to come up with the adapted version. The subject areas of study are:

i) **Material Science in Metalworking:** In this area, knowledge of the physical, chemical and mechanical properties of materials, including metal alloys, is developed and integrated. Additionally, material knowledge is applied to creatively and safely address metalwork and design challenges while emphasising sustainability.

ii) **Metal Fabrication Technology:** This area captures the acquisition of technical knowledge, practical skills, design application, safety, troubleshooting, innovation and career development in the field of metal fabrication.

iii) **Metal Casting and Foundry Practices:** This metal work study area includes the principles, processes, skills, safety, innovation, sustainability, teamwork and career preparation involved in the casting and shaping of metals through foundry work.

## 1.13 Time Allocation

The learners shall be engaged for eight (8) periods per week from Senior Five to Senior Six.

## 1.14 Suggested Approaches to Teaching Metalwork

The suggested approaches enhance learning and empower teachers to support learners as they prepare for assessments. This will necessitate teachers to work alongside learners to guide, direct, support and supervise them as they progress through the metalwork processes. These approaches include:

1. **Project and project-based learning**. Learners design and fabricate a functional metal product (e.g. an office table frame, portable chalkboard stand, window burglar proofing, armchair frame) based on specific community needs. They will document each step of the process, from material selection to final product. This will help them acquire critical thinking, analytical and problem-solving skills.
2. **Experimental learning**. Learners conduct the welding of different types of metals to observe the effects of different welding techniques, compare the results, differences in strength, appearance, and ease of welding. This will help to build on their hands-on skills through experimentation.
3. **Brainstorming**. Learners participate in a group discussion session to generate ideas for a metal product that solves a specific community problem (e.g. tool for farmers). After generating ideas, the group discusses the feasibility and selects the best design that will help solve the problem. This will improve on their communication, critical thinking and problem-solving skills.
4. **Collaborative and group work learning**. In small groups, learners collaboratively work on fabricating a metal product that requires different skills from each group member. Each member is responsible for one part of the process, such as measuring, cutting, or welding. This will help in building their effective communication and teamwork skills.

5. **Jigsaw method**. Each learner is tasked with a specific aspect of metalworking (e.g. material selection, welding, fabrication, finishing) to research and become an expert in it. Then, learners come together in new groups where they share their findings and, collectively, the group assembles the product. This will help build on their collaborative and analytical skills.
6. **Observation**. Learners observe an expert metalworker (a colleague) or instructor demonstrating a technique (e.g. welding a joint). After the demonstration, a learner practises the technique him/herself using the observed methods as a model for their own work. This develops generic skills of adaptability, patience, objectivity and problem-solving.

## 1.15 Program planner

| Class/ Term | Topic | Sub-topic | Periods |
|---|---|---|---|
| **Senior Five Term 1** | / , Engineering Materials | 1.1. Metallic Material, Properties and Uses. | 50 |
| | | 1.2. Metal Sustainability and Environmental Awareness | 10 |
| **Senior Five Term 2** | 0, Metal Fabrication Processes | 2.1 Planning, Design and Assembling | 36 |
| | | 2.2 Metal Cutting and Forming Processes | 44 |
| **Senior Five Term 3** | 1, Metal Fabrication Process (Arc Welding and Fasteners) | 3.1 Metal Joining Processes (Arc Welding and Fasteners) | 58 |
| | | 3.2 Finishing of Fabricated Products Using Arc Welding and Fasteners | 22 |
| **Senior Six Term 1** | 4 Metal Fabrication Process (Gas Welding, Brazing and Soldering) | 4.1 Metal Joining Processes (Gas Welding, Brazing and Soldering) | 60 |
| | | 4.2 Complementary Materials in Metal Fabrication | 20 |
| **Senior Six Term 2** | 5 Foundry (Sand Casting) | 5.1 Pattern Making | 16 |
| | | 5.2 Moulding Box Making (Flask) | 12 |
| | | 5.3 Core Making Process | 12 |
| | | 5.4 Moulding Sand Making | 12 |
| | | 5.5 Mould Making Process | 16 |
| | | 5.6 Melting and Pouring | 12 |
| **Senior Six Term 3** | 6 Foundry (Fettling Process) | 6.1 Fettling Processes | 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

## TOPIC 1: Engineering Materials

**Duration:** 60 Periods

**Competency:** The learner tests engineering materials to determine their properties to inform the fabrication processes:

| Learning Outcomes<br>The learner should be able to: | Suggested Learning Activities | Sample Assessment Strategy |
|---|---|---|
| a) categorise the materials used in metal fabrication processes. (k, u, s, gs) | a) Learners, in groups, explore manufactured products in their environment that are made from different materials. Through guided inquiry, they investigate and identify the properties of these materials, discuss the purpose and function of the various material types and then present their findings to the class.<br>b) Independently Leaners explore different types of materials and later compare, select and combine their work in groups, assess their suitability for metalworking and present their findings to the class.<br>c) Using experimental learning, provide learners with a range of metal samples (e.g. steel, aluminium, copper, cast iron, brass) and guide them to identify and classify each as either ferrous or non-ferrous. Encourage them to work collaboratively to create a chart that lists the metal names alongside their appropriate categories. | a) Observe learners' communication skills as they discuss identified materials focussing on their ability to:<br>i) Talk confidently and express their opinion clearly.<br>ii) Effectively exchange ideas within the group.<br>iii) Search and present accurate formation using ICT and verbally.<br>b) Probe learners' abilities to:<br>i) Categorise various types of metal properties.<br>ii) Make scientific judgements based on the magnetic effect of metals.<br>c) Assess the charts presented for:<br>i) The proper names of metals.<br>ii) Categories of ferrous and non-ferrous metals identified. |

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|---|---|---|
| b) apply heat treatment to metal to improve its performance and suitability for specific engineering applications. (k, u, s, gs) | a) Using the jigsaw method, learners, in groups, use charts to study the heat treatment process and establish why it is done on metal. They engage in collaborative and mutual learning as they present their findings in class.<br>b) Using guided discovery, organise learners into groups to work with identified steel metal samples and perform heat treatment processes such as hardening, annealing, and normalising. Guide them to observe and analyse the resulting changes in the properties of the metal. Encourage them to discuss their findings within their groups and present their observations to the class. | a) Observe learners' problem-solving skills during heat treatment processes, focusing on their ability to:<br>i) Identify and diagnose issues in the heat treatment process, such as uneven heating or material defects.<br>ii) Make informed and confident decisions promptly throughout the heating process.<br>b) Probe learners on:<br>i) The procedure of preparing a metal to be heat treated.<br>ii) Temperature control and recoding during the process.<br>iii) Identifying colour changes in metals during heating.<br>iv) The cooling process of heated metallic materials.<br>v) Post-treatment of metallic material.<br>c) Assess the learners' heated product for:<br>i) Changes in the physical properties of materials.<br>ii) Changes in the mechanical properties of materials.<br>iii) Surface finish of material. |
| c) apply sustainable practices in metalworking activities in the community. (k, u, s, gs) | a) Learners brainstorm the meaning of sustainability practices and their importance to the community.<br>b) In a guided discovery, learners move around the school environment and inspect the storage and disposal of metallic materials and report to the class. | a) Evaluate learners' innovative thinking as they design environmental protection projects focusing on:<br>i) Their ability to generate unique and diverse ideas.<br>ii) Skills in utilising available resources creatively to tackle environmental challenges. |

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|---|---|---|
| | c) Learners, in groups, design and develop projects focused on environmental protection, such as metal disposal and recycling initiatives. | b) Probe learners to:<br>i) Analyse community needs regarding the storage and disposal of metallic materials.<br>ii) Designing products that address the community needs.<br>c) Evaluate the learners' designed product based on:<br>i) Material selection and surface finishing.<br>ii) Safety, with a focus on ergonomics and user-friendliness.<br>iii) Sustainability, assessing its environmental impact and resource efficiency.<br>iv) Aesthetic appeal and design, emphasising visual and functional aspects. |

## TOPIC 2: Metal Fabrication Processes (Designing, Measuring and Cutting)

**Duration:** 80 Periods

**Competency:** The learner designs, interprets technical drawings and proficiently applies measuring, cutting and holding tools on metal materials to produce products within their community.

| **Learning Outcomes** The learner should be able to: | **Suggested Learning Activities** | **Sample Assessment Strategy** |
|---|---|---|
| a) develop designs of metal products for use in the community. (k, u, s, gs) | a) Learners collaborate in groups to brainstorm and sketch various ideas for designing a metal product that addresses a community need.<br>b) Using modelling, learners create graphical presentations of their developed prototypes, including:<br>i) Freehand sketches.<br>ii) Accurate and precision designs.<br>iii) Isometric projections.<br>iv) Orthographic projections.<br>c) Using project-based learning, learners, in groups, identify, e.g. storage facility, waste disposal, gaps within the school, and then develop a portfolio to address the gaps identified. Put emphasis on:<br>i) Material selection.<br>ii) Working drawings.<br>iii) Manufacturing processes.<br>iv) Costing. | a) Observe the learners' critical thinking skills during the brainstorming session on metalwork product design processes for their ability to:<br>i) Generate innovative design solutions.<br>ii) Select the most effective and practical design solutions.<br>b) Probe learners' ability to:<br>i) Identify ideas that address the community's needs or design challenges the metal product aims to address.<br>ii) Comply with industrial standards and conventions.<br>iii) Ensure safe waste disposal.<br>c) Assess learners' output design on:<br>i) Product finish.<br>ii) Accuracy of the product made based on the design drawings<br>iii) The effectiveness of the budgeting process. |

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|---|---|---|
| b) make products that employ cutting processes e.g. G-Clamp, door hinges, keys and key ways. (k, u, s, gs) | a) Using think and pair technique, learners share information on different types of metal cutting processes and then present the findings to the class.<br>b) In groups, using mind mapping, the learners explore various resources to identify and discuss the different metal cutting processes, prepare visual aids and present their findings to the class.<br>c) Using project-based learning, the learners work independently or in groups to create products like a G-clamp, door hinges, or keys and keyways, following the steps of designing graphical plans, selecting materials, marking out, and using appropriate cutting tools to complete the task. | a) Observe learners' collaboration skills during the discussions on cutting processes to make products for their ability to:<br>i) Communicate and engage with others.<br>ii) Manage tasks and time efficiently.<br>b) Show respect for differing opinions. a. Dialogue with learner's to:<br>i) Analyse information related to the chosen metalwork products during the cutting processes.<br>ii) Consider the cutting techniques during the design process.<br>c) Assess a learner's product based on:<br>i) How he/she interpreted the designs made.<br>ii) The Accuracy exhibited in assembling the product. |
| c) apply mechanical force to reshape metallic material to achieve a desired shape. (k, u, s, gs) | a) Learners, in groups, are guided to search for information on different types of metal forming processes and present their findings to the class.<br>b) Using a step-by-step guided practice, learners make products that employ forming processes, e.g. hammer-heads, chisels, couplings following the process of:<br>i) Making graphical designs.<br>ii) Identification of material.<br>iii) Forging (hot and cold working). | a) Observe learners' creativity while making products that employ forming processes for their ability to:<br>i) Demonstrate resourcefulness in selecting and combining materials in unique and effective ways.<br>ii) Show distinct and imaginative ideas, moving beyond expected ways or traditional approaches but conforming to the standards. |

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|---|---|---|
| | | iii) Explore innovative alternatives in the forming techniques.<br>b) Probe learners' ability to:<br>i) Categorise different types of metal forming processes.<br>ii) Test alternative forms of shaping metal.<br>c) Assess the product based on:<br>i) Functionality and performance in the metal forming process.<br>ii) Safety and ergonomics during use.<br>iii) Sustainability and environmental impact. |

## TOPIC 3: Metal Fabrication process (*Arc Welding and Fasteners*)

**Duration:** 80 Periods

**Competency:** The learner demonstrates skills of metal fabrication to make metal components that meet customer demands and specifications within the community by use of fasteners and arc welding.

| **Learning Outcomes** The learner should be able to: | **Suggested Learning Activities** | **Sample Assessment Strategy** |
|---|---|---|
| a) Use different types of joints to assemble metal parts in the construction of various metal products. (k, u, s, gs) | a) Using the jigsaw method, learners analyse extracts on temporary or permanent metal joining methods, share their findings, and critique each other's work.<br>b) A learner uses project-based learning to design and make metal products like an office table frame, portable chalkboard stands, window burglar proofing, armchair frame etc. that employ arc welding and fasteners.<br>c) Using guided discovery, learners explore the arc welding process and fasteners to design and create metal products like an office table frame, portable chalkboard stand etc. that employ the arc welding method. | a) Observe learners' problem-solving skills as they read and analyse the provided extract on metal joining for their ability to break down the extract into key concepts and identify the main issues or challenges related to metal joining.<br>b) Dialogue with learner to generate ideas for metal joining and design metal products.<br>c) Assess the learners produced product basing on:<br>i) The accuracy of the product.<br>ii) Quality of joints of the jointed product. |
| b) apply finishing to metal fabricated products to enhance surface quality and functionality. (k, u, s, gs) | a) Learners in groups, search for information about metal fabricated products finishing and its importance, and present in the plenary.<br>b) Using any fabricated product, learners perform the finishing techniques, putting emphasis on safety and procedures. | a) Observe learners' creative skills on applying finish to metal products for their ability to:<br>i) Exhibit precision and care in applying finishes to achieve a high-quality and polished appearance.<br>ii) Balance aesthetics with functionality, such as using finishes to improve durability, resistance to corrosion or usability. |

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|---|---|---|
| | | iii) Explore different finishing possibilities.<br>b) Probe a learner's ability to generate alternative ideas for metal finishing.<br>c) Evaluate the finished product based on:<br>i) The surface smoothness and texture of the product.<br>ii) The safety measures employed to protect it. |

## TOPIC 4: Metal Fabrication process (*Gas Welding, Brazing and Soldering* )

**Duration:** 80 Periods

**Competency:** The learner demonstrates skills of metal fabrication to make metal components that meet customer demands and specifications within the community using gas welding, brazing and soldering processes.

| **Learning Outcomes** The learner should be able to: | **Suggested Learning Activities** | **Sample Assessment Strategy** |
|---|---|---|
| a) use different types of joints to assemble metal parts in the construction of various metal products. (k, u, s, gs) | a) Using the jigsaw method, learners analyse extracts on permanent metal joining methods (gas welding, brazing and soldering), share their findings, and critique each other's work.<br>b) learner uses project-based learning to design metal products like an office table frame, portable chalkboard stands, window burglar proofing, armchair frame etc. that employ gas welding, brazing and soldering.<br>c) Using project-based learning, a learner makes items such as office table frame, portable chalkboard stand, window burglar proofing, armchair frame using gas welding, brazing and soldering. | a) Observe learners critical thinking skills as they read and analyse the provided extract on gas welding, brazing and soldering for their ability to:<br>i) Break down the extract into its core components to understand the principles, techniques and applications of gas welding, brazing and soldering.<br>ii) Draw logical predictions about the effectiveness of each method based on the information provided.<br>iii) Evaluate which technique is most suitable for a given scenario, based on the analysis of the extract.<br>b) Probe a learner's ability to:<br>i) Generate ideas for gas welding, brazing and soldering.<br>ii) Distinguish the different types of flames and functions.<br>iii) Design different types of products like an office table frame, portable chalkboard stands, window burglar proofing, armchair frame etc.<br>c) Asses the produced product, based on whether:<br>i) The joined product meets dimensional and tolerance requirements. |

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|---|---|---|
| | | ii) The joint is free of cracks or pores that could weaken the structure.<br>iii) The joint can withstand the required load or stress without failure. |
| b) integrate complementary materials in metalworking processes. (k, u, s, gs) | a) Using guided discovery, learners walk around the school to find out materials used to supplement metal products and present in class:<br>i) The types of complementary materials discovered.<br>ii) Factors of choice of complementary materials.<br>iii) How complementary materials are bonded to metal.<br>b) Using the project-based learning method, learners design a metallic product with complementary material, e.g. glass | a) Observe learners' problem-solving skills as they find out complementary materials used with metals for their ability to:<br>i) Gather, analyse and interpret information about materials that work well with metals.<br>ii) Assess the properties of complementary materials (e.g., plastics or glass) to determine their compatibility with metals.<br>iii) Identify innovative or less conventional materials to enhance the functionality or aesthetics of metal products<br>b) Probe a learner's ability to:<br>i) Find alternative complementary materials that can be integrated to metal.<br>ii) Justify why the particular materials have been chosen to integrate with metal.<br>iii) Describe bonding techniques used to integrate these materials.<br>c) Asses the metal product with integrated material based on:<br>i) Suitability of the complementary materials depending on purpose.<br>ii) Visual Appeal.<br>iii) Seamless integration. |

## TOPIC 5: Foundry Technology

**Duration:** 80 Periods

**Competency:** The learner makes products using foundry technology (sand casting) to benefit the surrounding communities.

| **Learning Outcomes** The learner will be able to: | **Suggested Learning Activities** | **Sample Assessment Strategy** |
|---|---|---|
| a) make patterns for metal casting for use in communities. (k, u, s, gs) | a) Using the brainstorming method, learners, in groups, discuss:<br>i) The meaning of foundry technology and its real-world applications.<br>ii) The materials and tools used in foundry.<br>iii) The processes and procedures in foundry technology.<br>iv) The safety practices used in foundry technology and present their finding to the class.<br>b) Using project-based learning, learners identify products needed in their community, design and make a pattern for foundry making. | a) Observe learners' communication skills during their brainstorming session on foundry technology to assess:<br>i) Their confidence in discussing ideas related to foundry.<br>ii) Their teamwork and ability to present their work on pattern making.<br>b) Assess the learner's ability to:<br>i) Apply the fundamental concepts of foundry technology.<br>ii) Correctly use materials and tools.<br>iii) Correctly observe the processes and procedures used in foundry.<br>c) Evaluate a learners' pattern products based on whether:<br>i) The pattern accurately represents the intended design with smooth and well-defined contours.<br>ii) Appropriate allowances have been made for metal shrinkage during cooling.<br>iii) Elements for feeding molten metal, such as runners, risers and gates, are incorporated.<br>iv) The final finish of the pattern. |

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| b) make a moulding box (flask) for metal casting for use by the community. (k, u, s, gs) | a) Through guided discovery, learners work in groups to explore and present their findings on the following areas:<br>i) The purpose of moulding boxes (flask) in foundry technology.<br>ii) The materials and tools used in the construction of moulding boxes (flasks) for foundries.<br>iii) The processes and procedures involved in making moulding boxes.<br>b) In a group project, learners design and make a moulding box for foundry making. | a) Observe the learners' creativity when moulding boxes in foundry technology for their ability to:<br>i) Develop unique designs or approaches for moulding boxes that conform to conventional standards.<br>ii) Find innovative solutions to challenges during the moulding process, such as material limitations or defects.<br>iii) Incorporate eco-friendly or recycled materials in the moulding process.<br>b) Probe the learner's knowledge on:<br>i) The choice and purpose of the designed moulding box.<br>ii) The choice of the materials, tools, processes and procedures involved in moulding box creation.<br>c) Assess the learners' moulding box based on:<br>i) The ability to meet specified dimensions and tolerances.<br>ii) Quality of the joints.<br>iii) It's ability to meet the intended purpose, compatibility, stacking or transportation. |
| c) form core prints for metal casting for use in communities. (k, u, s, gs) | a) Using guided discovery, learners, in groups, search and present findings on:<br>i) The importance of core prints used in foundry technology.<br>ii) The materials and tools used for making core prints in foundry.<br>iii) The processes and procedures for core print making. | a) Observe learners' cooperation skills as they discuss on core prints used in foundry technology based on their ability to:<br>i) Actively contribute to relevant ideas and insights about core prints.<br>ii) Value and consider different viewpoints from members regarding core print designs and applications.<br>b) Probe learners on:<br>i) The explanation about core prints. |

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| | b) Using project-based learning, learners, in groups, will design and make core prints for foundry technology. | ii) Reasons for choice of materials, tools, processes and procedures used in core prints.<br>c) Assess learners' core print product for:<br>i) The quality of core print design.<br>ii) The types of materials selected for moulding core print.<br>iii) The quality of final finishing used on a core print. |
| d) prepare moulding sand to make strong moulds for use in metal castings. (k, u, s, gs) | a) Learners, through guided discovery, work in groups, to research about the components of moulding sand and present their findings on the following:<br>i) The description of moulding sand in foundry technology.<br>ii) The materials and tools used to make moulding sand in a foundry.<br>iii) The processes and procedures involved in making moulding sand.<br>b) Using project-based learning, learners, in groups, will prepare moulding sand for foundry technology. | a) Assess learners' communication skills during group discussions on moulding sand technology by evaluating:<br>i) Their confidence in articulating ideas.<br>ii) Their respect for differing perspectives.<br>iii) Their ability to work collaboratively within the group.<br>b) Probe learners to bring out information on moulding sand used in foundry based on:<br>i) Choice of materials for making sand castings.<br>ii) Material preparation and tools selection.<br>iii) Moulding processes and procedures.<br>c) Assess learners' moulding sand for:<br>i) The quality of the mixture.<br>ii) Correct use of additives, such as clay or other binders, to improve the sand's bonding and moulding properties. |
| e) create accurate moulds for metal casting that ensure precision and defect free casting. (k, u, s, gs) | a) In groups, learners will use the guided discovery method to search information on preparing sand moulds and present their findings on:<br>i) The description of moulds used in foundry technology. | a) Observe learners' collaboration skills as they search information on preparing sand moulds to assess:<br>i) Their confidence in expressing ideas.<br>ii) Their respect for others' ideas.<br>b) Probe learners to provide information on:<br>i) Centring mould boxes. |

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| | ii) The materials and tools required for making sand moulds.<br>iii) The processes and procedures involved in mould making.<br>b) Through project-based learning, learners work in groups to prepare sand moulds for foundry technology tasks. | ii) Mixing and Compacting moulding sand.<br>iii) Placing sprue pins to create risers and feeders.<br>c) Evaluate learners' moulds, focusing on:<br>i) Accurate linings of the mould.<br>ii) Vents on the mould.<br>iii) Absence of sand particles. |
| f) demonstrate the ability to safely melt metal and pour it into moulds to create high-quality castings. (k, u, s, gs) | a) Using guided discovery, learners work in groups to research about the process of heating and melting metal in casting and present their findings on:<br>i) The types of metals used in casting.<br>ii) The tools and equipment involved in casting.<br>iii) The metal melting process.<br>iv) The types of fluxing agents and their roles in casting.<br>b) Using project-based learning, learners, in groups, demonstrate the heating and pouring process of metal to make a casting. | a) Observe learners' communication skills as they demonstrate the process of heating and pouring molten metal into a mould to create a casting for their ability to:<br>i) Respect others' perspectives.<br>ii) Maintain focus without getting distracted.<br>iii) Articulate steps and instructions clearly and concisely.<br>b) Probe learners to:<br>i) Explain the properties of metals used in casting.<br>ii) Describe the tools and equipment used for heating metal.<br>c) Assess learners' casting based on:<br>i) Matching the specifications and tolerances required by the design.<br>ii) Smoothness.<br>iii) Quality of the product. |

## TOPIC 6: Foundry Technology (Fettling Process)

**Duration:** 48 Periods

**Competency:** The learner performs finishing processes on casted materials to meet specified dimensions and accuracy using both hand tools and machine tools while demonstrating precision, safety, and proper techniques throughout the process.

| Learning Outcomes<br>The learner will be able to: | Suggested Learning Activities | Sample Assessment Strategy |
|---|---|---|
| a) demonstrate surface finishing on a casting to meet the required standards for its intended use by the customer. (k, u, s, gs) | a) Using the brainstorming method, learners work in groups to explore techniques for:<br>i) Removing a casting from the mould.<br>ii) Cutting off excess metal from the casting.<br>iii) Securing the casting in a vice.<br>iv) Grinding and polishing the casting.<br>b) Through project-based learning, learners work in groups to perform surface finishing on a casting using a provided sample of a pre-made casting and make a report. | a) Observe learners' skills as they demonstrate how to finish a cast product and their ability to:<br>i) Identify imperfections in the cast product that need to be addressed.<br>ii) Decide which defects to address first based on their impact on the product's quality.<br>b) Probe learners' understanding about surface finishing for castings based on:<br>i) Securing the casting on holding devices such as bench vices or clamps.<br>ii) Safety measures required during surface finishing.<br>iii) Marking out the casting.<br>iv) Labelling and branding the casting.<br>c) Assess learners' report on surface finishing of castings, focusing on:<br>i) Method used to make the casting.<br>ii) Process for removing the casting from the mould.<br>iii) The techniques for securing the casting on holding devices such as bench vices or clamps.<br>iv) The approach to marking out on the casting.<br>v) The process of cutting and grinding excess metal.<br>vi) The inspection procedure for the finished casting.<br>vii) The steps involved in labelling and branding the casting. |

# 3.0 ASSESSMENT

## 3.1 Assessing Metalwork

The adapted 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 and a.

It is not possible to assess 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.

So, this section focuses on knowledge, understanding and skills. Each has its own implications for learning and assessment.

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.

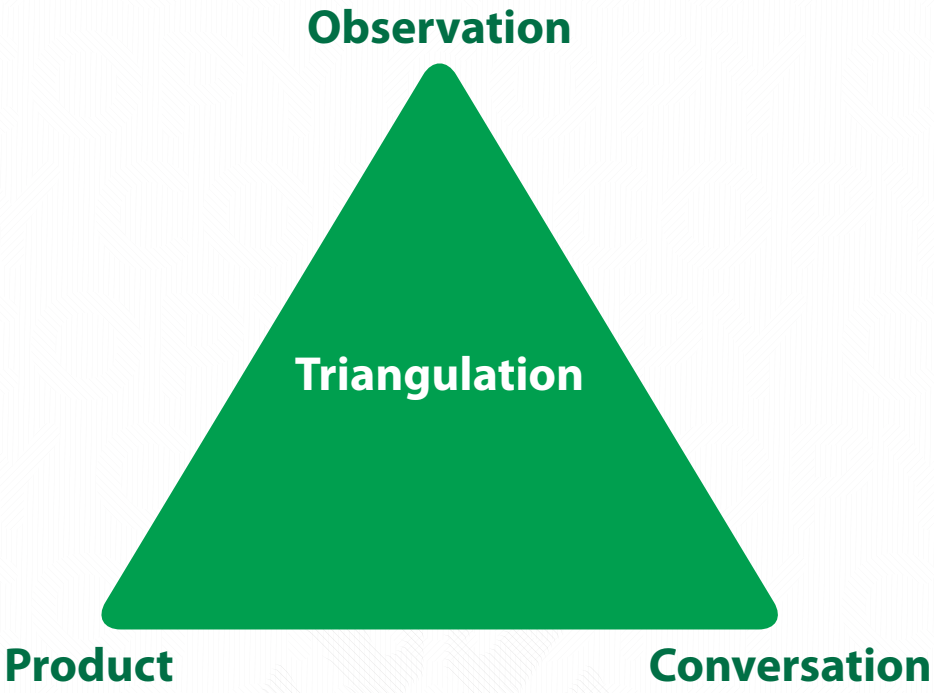
## 3.2 Formative Assessment

In this adapted curriculum, the teacher's assessment role is not only to write tests for learners, but to make professional judgements about learners' learning in the course of the normal teaching and learning process. The professional judgement is about how far the learner achieves the Learning Outcomes that are set out in this syllabus. To make these judgements the teacher needs to look at how well the learners are 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, not something that the learner says.

When all three are used, the information from anyone 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 syllabi 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.

## 3.7 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' achievements.**

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 FOR KEY TERMS

| Term | Definition |
|---|---|
| **Competency curriculum** | One in which a learner develops the ability to apply his/her 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 a learner 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 to 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 which gives a learner the opportunity to show the extent to which he/she 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. |

**CONTACT US:**

National Curriculum Development Centre
Plot M838, Kyambogo.
P.O.Box 7002 Kampala, Uganda
+256-393-112-088
**www.ncdc.go.ug**

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