APPLIED TECHNOLOGY

CURRICULUM FOR SECONDARY EDUCATION (SHS 1 - 3)

NaCCA

NATIONAL COUNCIL FOR CURRICULUM & ASSESSMENT OF MINISTRY OF EDUCATION

MINISTRY OF EDUCATION
REPUBLIC OF GHANA

SEPTEMBER 2023

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FOREWORD

Through the National Council for Curriculum and Assessment (NaCCA), Ghana's Ministry of Education has introduced a series of curriculum reforms to improve the quality and relevance of learning experiences in pre-tertiary schools in the country. These reforms will improve learning through the introduction of innovative pedagogies that encourage critical thinking and problem-solving. For a long time, our learners memorise facts and figures, which does not develop their analytical and practical skills. The Ministry recognises that learners need to be equipped with the right tools, knowledge, skills and competencies to deal with the fast-changing environment and the challenges facing their communities, the nation and the world.

These curriculum reforms were derived from the Education Strategic Plan (ESP 2018-2030), the National Pre-tertiary Education Curriculum Framework (NPTECF) and the National Pre-Tertiary Learning Assessment Framework (NPLAF), which were all approved by Cabinet in 2018. The new standards-based curriculum implemented in 2019 in basic schools, aims to equip learners to apply their knowledge innovatively to solve everyday problems. It also prioritises assessing learners' knowledge, skills, attitudes, and values, emphasising their achievements. The content of the basic school standards-based curriculum was therefore designed to promote a curriculum tailored to the diverse educational needs of the country's youth. It addresses the current curriculum's deficiencies in learning and assessment, especially in literacy and numeracy. These reforms have been carried out in phases. The curriculum for the basic school level – KG, Primary and Junior High School (JHS) – was developed and implemented from 2019 to 2021.

The curriculum for Senior High School (SHS), Senior High Technical School (SHTS) and Science, Technical, Engineering and Mathematics (STEM), which constitutes the next phase, is designed to ensure the continuation of learning experiences from JHS. It introduces flexible pathways for progression to facilitate the choice of subjects necessary for further study, the world of work and adult life. The new SHS, SHTS and STEM curriculum emphasises the acquisition of 21st Century skills and competencies, character development and instilling of national values. Social and Emotional Learning (SEL), Information Communications Technology, Gender Equality and Social Inclusion, have all been integrated into the curriculum. Assessment – formative and summative has been incorporated into the curriculum and aligned with the learning outcomes throughout the three-year programme.

The Ministry of Education's reform aims to ensure that graduates of our secondary schools can successfully compete in international high school competitions and, at the same time, be equipped with the necessary employable skills and work ethos to succeed in life. The Ministry of Education, therefore, sees the Senior High School (SHS) curriculum as occupying a critical place in the education system – providing improved educational opportunities and outcomes for further studies, the world of work and adult life – and is consequently prioritising its implementation.

ACKNOWLEDGEMENTS

This standards-based SHS curriculum was created using the National Pre-Tertiary Learning Assessment Framework (NPLAF), the Secondary Education Assessment Guide (SEAG), and the Teacher and Learner Resource Packs which include Professional Learning Community (PLC) Materials and Subject Manuals for teachers and learners. All the above-mentioned documents were developed by the National Council for Curriculum and Assessment (NaCCA). The Ministry of Education (MoE) provided oversight and strategic direction for the development of the curriculum with NaCCA receiving support from multiple agencies of the MoE and other relevant stakeholders. NaCCA would like to extend its sincere gratitude, on behalf of the MoE, to all its partners who participated in the professional conversations and discussions during the development of this SHS curriculum.

In particular, NaCCA would also like to extend its appreciation to the leadership of the Ghana Education Service (GES), the National School Inspectorate Authority (NaSIA), the National Teaching Council (NTC), the Commission for Technical and Vocational Education and Training (Commission for TVET), West African Examinations Council (WAEC) and other agencies of the MoE that supported the entire process. In addition, NaCCA acknowledges and values the contributions made by personnel from various universities, colleges of education Industry players, Vice Chancellors Ghana, Vice Chancellors Technical Universities as well as educators and learners working within the Ghana education landscape.

Special appreciation is extended to consultants who contributed to development of the curriculum. The development process involved multiple engagements between national stakeholders and various groups with interests in the curriculum. These groups include the teacher unions, the Association of Ghana Industries, and heads of secondary schools.

CONTENTS

YEAR THREE

THE SHS CURRICULUM OVERVIEW

The vision for this curriculum is to ensure the nation has a secondary education system that enables all Ghanaian children to acquire the 21st Century skills, competencies, knowledge, values and attitudes required to be responsible citizens, ready for the world of work, further studies and adult life. The nation's core values drive the SHS curriculum, and it is intended to achieve Sustainable Development Goal 4: 'Inclusive, equitable quality education and life-long learning for all'. Above all, it is a curriculum enabling its graduates to contribute to the ongoing growth and development of the nation's economy and well-being.

The curriculum is inclusive, flexible, and robust. It was written under the auspices of the National Council for Curriculum and Assessment by a team of expert curriculum writers across Ghana. It reflects the needs of critical stakeholders, including industry, tertiary education, the West African Examination Council, SHS learners, teachers, and school leaders. It has been written based on the National Pre-Tertiary Learning and Assessment Framework and the Secondary Education Policy.

The key features of the curriculum include:

- flexible learning pathways at all levels, including for gifted and talented learners and those with deficiencies in numeracy and literacy, to ensure it can meet the needs of learners from diverse backgrounds and with different interests and abilities.
- the five core learning areas for secondary education: science and technology, language arts, humanities, technical and vocational and business; with emphasis placed on STEM and agriculture as integral to each subject.
- a structured, standards-based approach that supports the acquisition of knowledge, skills and competencies, and transition and seamless progress throughout secondary education, from JHS to SHS and through the three years of SHS.
- a focus on interactive approaches to teaching and assessment to ensure learning goes beyond recall enabling learners to acquire the ability to understand, apply, analyse and create.
- guidance on pedagogy, coupled with exemplars, demonstrating how to integrate cross-cutting themes such as 21st Century skills, core competencies, the use of ICT, literacy and mathematics, Social Emotional Learning, Gender Equality and Social Inclusion as tools for learning and skills for life. Shared Ghanaian values are also embedded in the curriculum.

The curriculum writing process was rigorous and involved developing and using a Curriculum Writing Guide which provided systematic instructions for writers. The process was quality assured at three levels: through (a) evaluation by national experts, (b) trialling curriculum materials in schools and (c) through an external evaluation by a team of national and international experts. Evidence and insights from these activities helped hone the draft's final version. The outcome is a curriculum coherently aligned with national priorities, policies and the needs of stakeholders. A curriculum tailored to the Ghanaian context ensures that all learners benefit from their schooling and develop their full potential.

The following section highlights the details of the front matter of the draft curriculum. The vision, philosophy and goal of the curriculum are presented. This is followed by the details of the 21st Century skills and competencies, teaching and learning approaches, instructional design and assessment strategies. The template for the curriculum frame, which outlines the scope and sequence, the design that links the learning outcomes to particular 21st Century skills and competencies, as well as Gender Equality and Social Inclusion, Social and Emotional Learning and Ghanaian values are presented together with the structure of the lesson frame showing the links between the content standards, learning indicators with their corresponding pedagogical exemplars and assessment strategies.

INTRODUCTION

Effective implementation of this Senior High School (SHS) curriculum is the key to creating a well-educated and well-balanced workforce that is ready to contribute to Ghana's progress by harnessing the potential of the growing youth population, considering the demographic transition the country is currently experiencing (Educational Strategic Plan [ESP] 2018-2030). SHS curriculum aims to expand equitable, inclusive access to relevant education for all young people, including those in disadvantaged and underserved communities, those with special educational needs and those who are gifted and talented. Senior High School allows young people to develop further skills and competencies and progress in learning achievement, building from the foundation laid in Junior High School. This curriculum intends to meet the learning needs of all high school learners by acquiring 21st Century skills and competencies to prepare them for further studies, the world of work and adult life. Changing global economic, social and technological context requires life-long learning, unlearning, and continuous processes of reflection, anticipation and action.

Philosophy of Senior High School Curriculum

The philosophy underpinning the SHS curriculum is that every learner can develop their potential to the fullest if the right environment is created and skilled teachers effectively support them to benefit from the subjects offered at SHS. Every learner needs to be equipped with skills and competencies of interest to further their education, live a responsible adult life or proceed to the world of work.

Vision of Senior High School Curriculum

The vision of the curriculum is to prepare SHS graduates equipped with relevant skills and competencies to progress and succeed in further studies, the world of work and adult life. It aims to equip all learners with the 21st Century skills and competencies required to be responsible citizens and lifelong learners. When young people are prepared to become effective, engaging, and responsible citizens, they will contribute to the ongoing growth and development of the nation's economy and well-being.

Goal of Senior High School Curriculum

The goal of the curriculum is to achieve relevant and quality SHS through the integration of 21st Century skills and competencies as set out in the Secondary Education Policy. The key features to integrate into the curriculum are:

- Foundational Knowledge: literacy, numeracy, scientific literacy, information, communication and digital literacies, financial literacy and entrepreneurship, cultural identity, civic literacy and global citizenship
- Competencies: critical thinking and problem-solving, innovation and creativity, collaboration, and communication
- Character Qualities: discipline, integrity, self-directed learning, self-confidence, adaptability and resourcefulness, leadership, and responsible citizenship.

The JHS curriculum has been designed to ensure that learners are adequately equipped to transition seamlessly into SHS, where they will be equipped with the relevant knowledge, skills and competencies. The SHS curriculum emphasises character building, acquisition of 21st Century skills and competencies and nurturing core values within an environment of quality education to ensure the transition to further study, the world of work and adult life. This requires the delivery of robust secondary education that meets the varied learning needs of the youth in Ghana. The SHS curriculum, therefore, seeks to develop learners to become technology-inclined, scientifically literate, good problem-solvers who can think critically and creatively and are equipped to communicate with fluency, and possess the confidence and competence to participate fully in Ghanaian society as responsible local and global citizens – (referred to as 'Glocal citizens').

The SHS curriculum is driven by the nation's core values of truth, integrity, diversity, equity, discipline, self-directed learning, self-confidence, adaptability and resourcefulness, leadership, and responsible citizenship, and with the intent of achieving the Sustainable Development Goal 4: 'Inclusive, equitable quality education and life-long learning for all'. The following sections elaborate on the critical competencies required of every SHS learner:

Gender Equality and Social Inclusion (GESI)

- Appreciate their uniqueness about others.
- Pay attention to the uniqueness and unique needs of others.
- Value the perspective, experience, and opinion of others.
- Respect individuals of different beliefs, political views/ leanings, cultures, and religions.
- Embrace diversity and practise inclusion.
- Value and work in favour of a democratic and inclusive society.
- Be conscious of the existence of minority and disadvantaged groups in society and work to support them.
- Gain clarity about misconceptions/myths about gender, disability, ethnicity, age, religion, and all other excluded groups in society
- Interrogate and dispel their stereotypes and biases about gender and other disadvantaged and excluded groups in society.
- Appreciate the influence of socialisation in shaping social norms, roles, responsibilities, and mindsets.
- Identify injustice and advocate for change.
- Feel empowered to speak up for themselves and be a voice for other disadvantaged groups.

21st Century Skills and Competencies

In today's fast-changing world, high school graduates must be prepared for the 21st Century world of work. The study of Mathematics, Science, and Language Arts alone is no longer enough. High school graduates need a variety of skills and competencies to adapt to the global economy. Critical thinking, creativity, collaboration, communication, information literacy, media literacy, technology literacy, flexibility, leadership, initiative, productivity, and social skills are needed. These skills help learners to keep up with today's fast-paced job market. Employers want workers with more than academic knowledge. The 21st Century skills and competencies help graduates navigate the complex and changing workplace. Also, these help them become active citizens who improve their communities. Acquisition of 21st Century skills in high school requires a change in pedagogy from the approach that has been prevalent in Ghana in recent years. Teachers should discourage and abandon rote memorisation and passive learning. Instead, they should encourage active learning, collaboration, and problem-solving, project-based, inquiry-based, and other learner-centred pedagogy should be used. As well as aligning with global best practices, these approaches also seek to reconnect formal education in Ghana with values-based indigenous education and discovery-based learning which existed in Ghana in pre-colonial times. This is aligned with the 'glocal' nature of this curriculum, connecting with Ghana's past to create confident citizens who can engage effectively in a global world. Digitalisation, automation, technological advances and the changing nature of work globally mean that young people need a new set of skills, knowledge and competencies to succeed in this dynamic and globalised labour market.

Critical Thinking and Problem-Solving Competency

- Ability to question norms, practices, and opinions, to reflect on one's values, perceptions, and actions.
- Ability to use reasoning skills to come to a logical conclusion.
- Being able to consider different perspectives and points of view
- Respecting evidence and reasoning
- Not being stuck in one position
- Ability to take a position in a discourse
- The overarching ability to apply different problem-solving frameworks to complex problems and develop viable, inclusive, and equitable solution options that integrate the above-mentioned competencies, promote sustainable development,

Creativity

- Ability to identify and solve complex problems through creative thinking.
- Ability to generate new ideas and innovative solutions to old problems.
- Ability to demonstrate originality and flexibility in approaching tasks and challenges.
- Collaborating with others to develop and refine creative ideas
- Ability to incorporate feedback and criticism into the creative process
- Utilising technology and other resources to enhance creativity
- Demonstrating a willingness to take risks and experiment with new approaches
- Adapting to changing circumstances and further information to maintain creativity

- Integrating multiple perspectives and disciplines to foster creativity
- Ability to communicate creative ideas effectively to a variety of audiences

Collaboration

- Abilities to learn from others; to understand and respect the needs, perspectives, and actions of others (empathy)
- Ability to understand, relate to and be sensitive to others (empathic leadership)
- Ability to deal with conflicts in a group
- Ability to facilitate collaborative and participatory problem-solving
- Ability to work with others to achieve a common goal.
- Ability to engage in effective communication, active listening, and the ability to compromise.
- Ability to work in groups on projects and assignments.

Communication

- Know the specific literacy and language of the subjects studied
- Use language for academic purposes
- Communicate effectively and meaningfully in a Ghanaian Language and English Language
- Communicate confidently, ethically, and effectively in different social contexts.
- Communicate confidently and effectively to different participants in different contexts
- Ability to communicate effectively verbally, non-verbally and through writing.
- Demonstrate requisite personal and social skills that are consistent with changes in society
- Ability to express ideas clearly and persuasively, listen actively, and respond appropriately
- Ability to develop digital communication skills such as email etiquette and online collaboration.
- Ability to engage in public speaking, debate, and written communication.

Learning for Life

- Understand subject content and apply it in different contexts
- Apply mathematical and scientific concepts in daily life
- Demonstrate mastery of skills in literacy, numeracy, and digital literacy.
- Develop an inquiry-based approach to continual learning.
- Be able to understand higher-order concepts and corresponding underlying principles.
- Participate in the creative use of the expressive arts and engage in aesthetic appreciation.
- Use and apply a variety of digital technologies
- Be digitally literate with a strong understanding of ICT and be confident in its application.
- Be equipped with the necessary qualifications to gain access to further and higher education and the world of work and adult life
- Ability to apply knowledge practically in the workplace so that they are able to utilise theory by translating it into practice.
- Develop their abilities, gifts and talents to be able to play a meaningful role in the development of the country
- Be able to think critically and creatively, anticipate consequences, recognise opportunities and be risk-takers
- Ability to pursue self-directed learning with the desire to chart a path to become effective lifelong learners.
- Independent thinkers and doers who show initiative and take action.
- Ability to innovate and think creatively, building on their knowledge base so that they take risks to achieve new goals
- Ability to think critically and solve problems so that they become positive change agents at work, in further study and in their personal lives.
- Be motivated to adapt to the changing needs of society through self-evaluation and ongoing training
- Be able to establish and maintain innovative enterprises both individually and in collaboration with others.
- Be able to ethically prioritise economic values to ensure stability and autonomy
- Show flexibility and preparedness to deal with job mobility
- Be committed towards the improvement of their quality of life and that of others
- Feel empowered in decision-making processes at various levels e.g., personal, group, class, school, etc.

- Be able to seek and respond to assistance, guidance and/or support when needed.
- Ability to make and adhere to commitments.
- Adopt a healthy and active lifestyle and appreciate how to use leisure time well.
- Be enthusiastic, with the knowledge, understanding and skill that enable them to progress to tertiary level, the world of work and adult life.
- Ability to transition from school to the world of work or further study by applying knowledge, skills and attitudes in new situations.
- Be independent, have academic and communication skills such as clarity of expression (written and spoken), and the ability to support their arguments.
- Be innovative and understand the 21st Century skills and competencies and apply them to everyday life.

Global and Local (Glocal) Citizenship

- Appreciate and respect the Ghanaian identity, culture, and heritage
- Be conscious of current global issues and relate well with people from different cultures
- Act in favour of the common good, social cohesion and social justice
- Have the requisite personal and social skills to handle changes in society
- Appreciate the impact of globalisation on the society.
- Ability to be an honest global citizen displaying leadership skills and moral fortitude with an understanding of the wider world and how to enhance Ghana's standing.

Systems Thinking Competency

- Ability to recognise and understand relationships
- Ability to analyse complex systems
- Ability to think of how systems are embedded within different domains and different scales
- Ability to deal with uncertainty

Normative Competency

- Ability to understand and reflect on the norms and values that underlie one's actions
- Ability to negotiate values, principles, goals, and targets, in a context of conflicts of interests and trade-offs, uncertain knowledge and contradictions

Anticipatory Competency

- Ability to understand and evaluate multiple futures – possible, probable, and desirable
- Ability to create one's vision for the future.
- Ability to apply the precautionary principle
- Ability to assess the consequences of actions
- Ability to deal with risks and changes

Strategic Competency

- Ability to collectively develop and implement innovative actions that further a cause at the local level and beyond.
- Ability to understand the bigger picture and the implications of smaller actions on them

Self-Awareness Competency

- The ability to reflect on one's role in the local community and (global) society
- Ability to continually evaluate and further motivate one's actions
- Ability to deal with one's feelings and desires

Social Emotional Learning (SEL): Five Core Competencies with Examples

1. *Self-Awareness*

Understanding one's emotions, thoughts, and values and how they influence one's behaviour in various situations. This includes the ability to recognise one's strengths and weaknesses with a sense of confidence and purpose. For instance:

- *Integrating personal and social identities;*
- *Identifying personal, cultural, and linguistic assets;*
- *Identifying one's emotions;*
- *Demonstrating honesty and integrity;*
- *Connecting feelings, values, and thoughts;*

- *Examining prejudices and biases;*
- *Experiencing self-efficacy;*
- *Having a growth mindset;*
- *Developing interests and a sense of purpose;*

2. *Self-Management*

The capacity to control one's emotions, thoughts, and actions in a variety of situations and to realise one's ambitions. This includes delaying obtaining one's desires, dealing with stress, and feeling motivated and accountable for achieving personal and group goals. For instance:

- *Managing one's emotions;*
- *Identifying and utilising stress-management strategies;*
- *Demonstrating self-discipline and self-motivation;*
- *Setting personal and group goals;*
- *Using planning and organisation skills;*
- *Having the courage to take the initiative;*
- *Demonstrating personal and collective agency;*

3. *Social Awareness*

The capacity to comprehend and care for others regardless of their backgrounds, cultures, and circumstances. This includes caring for others, understanding larger historical and social norms for behaviour in different contexts, and recognising family, school, and community resources and supports. For instance:

- *Recognising others' strengths*
- *Demonstrating empathy and compassion*
- *Caring about others' feelings*
- *Understanding and expressing gratitude*
- *Recognising situational demands and opportunities*
- *Understanding how organisations and systems influence behaviour*

4. *Relationship Skills*

The capacity to establish and maintain healthy, beneficial relationships and adapt to various social situations and groups. This includes speaking clearly, listening attentively, collaborating, solving problems and resolving conflicts as a group, adapting to diverse social and cultural demands and opportunities, taking the initiative, and asking for or offering assistance when necessary. For instance:

- *Communicating effectively;*
- *Building positive relationships;*
- *Demonstrating cultural competence;*
- *Working as a team to solve problems;*
- *Constructively resolving conflicts;*
- *Withstanding negative social pressure;*
- *Taking the initiative in groups;*
- *Seeking or assisting when needed;*
- *Advocating for the rights of others.*

5. *Responsible Decision-Making*

The capacity to make thoughtful and constructive decisions regarding acting and interacting with others in various situations. This includes weighing the pros and cons of various personal, social, and group well-being actions. For example:

- *Demonstrating curiosity and an open mind;*
- *Solving personal and social problems;*
- *Learning to make reasonable decisions after analysing information, data, and facts;*
- *Anticipating and evaluating the effects of one's actions;*
- *Recognising that critical thinking skills are applicable both inside and outside of the classroom;*
- *Reflecting on one's role in promoting personal, family, and community well-being;*
- *Evaluating personal, interpersonal, community, and institutional impacts*

Learning and Teaching Approaches

Learning and teaching should develop learners as self-directed and lifelong learners. Learners must be helped to build up deep learning skills and competencies to develop the ability to acquire, integrate and apply knowledge and skills to solve authentic and real-life problems. Learners need to be exposed to a variety of learning experiences to enable them to collaborate with others, construct meaning, plan, manage, and make choices and decisions about their learning. This will allow them to internalise newly acquired knowledge and skills and help them

to take ownership of their education. The 21st Century skills and competencies describe the relevant global and contextualised skills that the SHS curriculum is designed to help learners acquire in addition to the 4Rs (Reading, wRiting, aRithmetic and cReativity). These skills and competencies, as tools for learning and teaching and skills for life, will allow learners to become critical thinkers, problem-solvers, creators, innovators, good communicators, collaborators, digitally literate, and culturally and globally sensitive citizens who are life-long learners with a keen interest in their personal development and contributing to national development.

Given the diverse needs of learners, teachers need to have a thorough grasp of the different pedagogies as they design and enact meaningful learning experiences to meet the needs of different learners in the classroom. The teaching-learning techniques and strategies should include practical activities, discussion, investigation, role play, problem-based, context-based, and project-based learning. Active learning strategies have become increasingly popular in education as they provide learners with meaningful opportunities to engage with the material. These strategies emphasise the use of creative and inclusive pedagogies and learner-centred approaches anchored on authentic and enquiry-based learning, collaborative and cooperative learning, differentiated teaching and learning, holistic learning, and cross-disciplinary learning. They include experiential learning, problem-based learning, project-based learning, and talk-for-learning approaches. Some of the pedagogical exemplars to guide learning and teaching of the SHS curriculum include:

- **Experiential Learning:** Experiential learning is a hands-on approach to learning that involves learners in real-world experiences. This approach focuses on the process of learning rather than the result. Learners are encouraged to reflect on their experiences and use them to develop new skills and knowledge. Experiential learning can take many forms, including internships, service learning, and field trips. One of the main benefits of experiential learning is that it allows learners to apply what they have learned in the classroom to real-world situations. This can help them develop a deeper understanding of the material and make connections between different concepts. Additionally, experiential learning can help learners develop important skills such as critical thinking, problem-solving and communication.
- **Problem-Based Learning:** Problem-based learning is an approach that involves learners in solving real-world problems. Learners are presented with a problem or scenario and are asked to work together to find a solution. This approach encourages learners to take an active role in their learning and helps them develop important skills such as critical thinking and problem-solving. One of the main benefits of problem-based learning is that it encourages learners to take ownership of their learning. By working together to solve problems, learners can develop important skills such as collaboration and communication. Additionally, problem-based learning can help learners develop a deeper understanding of the material as they apply it to real-world situations.
- **Project-Based Learning:** Project-based learning is a hands-on approach to learning that involves learners in creating a project or product. This approach allows learners to take an active role in their learning and encourages them to develop important skills such as critical thinking, problem-solving, collaboration, and communication. One of the main benefits of project-based learning is that it allows learners to apply what they have learned in the classroom to real-world situations. Additionally, project-based learning can help learners develop important skills from each other and develop a deeper understanding of the material.
- **Talk for Learning Approaches:** Talk for learning approaches (TfL) are a range of techniques and strategies that are used to encourage learners to talk by involving them in discussions and debates about the material they are learning. This approach encourages learners to take an active role in their learning and helps them develop important skills such as critical thinking, collaboration and communication and also makes them develop confidence. One of the main benefits of TfL is that it encourages learners to think deeply about the material they are learning. By engaging in discussions and debates, learners can develop a deeper understanding of the material and make connections between different concepts.
- **Initiating Talk for Learning:** Initiating talk for learning requires the use of strategies that would encourage learners to talk in class. It helps learners to talk and participate meaningfully and actively in the teaching and learning process. Apart from developing skills such as communication and critical thinking, it also helps learners to develop confidence. Some strategies for initiating talk among learners are Activity Ball; Think-Pair-Share; Always, Sometimes, Never True; Matching and Ordering of Cards.
- **Building on What Others Say:** Building on what others say is an approach that involves learners in listening to and responding to their classmates'

ideas. This approach encourages learners to take an active role in their learning and helps them develop important skills such as critical thinking and communication. One of the main benefits of building on what others say is that it encourages learners to think deeply about the material they are learning. By listening to their classmates' ideas, learners can develop a deeper understanding of the material and make connections between different concepts. Additionally, building on what others say can help learners develop important skills such as collaboration and reflection. Some of the strategies to encourage learners to build on what others say are brainstorming, concept cartoons, pyramid discussion, and 5 Whys, amongst others.

- **Managing Talk for Learning:** Managing talk for learning requires the use of various strategies to effectively coordinate what learners say in class. Effective communication is a crucial aspect of learning in the classroom. Teachers must manage talk to ensure that learners are engaged, learning, and on-task in meaningful and purposeful ways. Some strategies for managing learners' contributions are debates, think-pair-share, sage in the circle etc.
- **Structuring Talk for Learning:** One effective way to shape learners' contributions is to structure classroom discussions. Structured discussions provide a framework for learners to engage in meaningful dialogue and develop critical thinking skills. Teachers can structure discussions by providing clear guidelines, such as speaking one at a time, listening actively, and building on each other's ideas. One popular structured discussion technique is the "think-pair-share" method. In this method, learners think about a question or prompt individually, and then pair up with a partner to discuss their ideas. Finally, the pairs share their ideas with the whole class. This method encourages all learners to participate and ensures that everyone has a chance to share their thoughts. Another effective way to structure talk for learning is to use open-ended questions. Open-ended questions encourage learners to think deeply and critically about a topic. They also promote discussion and collaboration among learners. Teachers can use open-ended questions to guide classroom discussions and encourage learners to share their ideas and perspectives. Other strategies that can be used are Concept/Mind Mapping, "Know," "Want to Know," "Learned" (KWL); Participatory Feedback; and the 5 Whys.
- **Diamond Nine:** The Diamond Nine activity is a useful tool for managing talk for learning in the classroom. This activity involves ranking items or ideas in order of importance or relevance. Learners work in groups to arrange cards or sticky notes with different ideas or concepts into a diamond shape, with the most important idea at the top and the least important at the bottom. The Diamond Nine activity encourages learners to think critically about a topic and prioritise their ideas. It also promotes collaboration and discussion among group members. Teachers can use this activity to introduce a new topic, review material, or assess student understanding.
- **Group Work/Collaborative Learning:** Group work or collaborative learning are effective strategies for managing talk for learning in the classroom. These strategies encourage learners to work together to solve problems, share ideas, and learn from each other. Group work and collaborative learning also promote communication and collaborative skills that are essential for success in the workplace and in life. To implement group work effectively, teachers must provide clear guidelines and expectations for group members. They should also monitor group work to ensure that all learners are participating and on-task. Teachers can also use group work as an opportunity to assess individual student understanding and participation.
- **Inquiry-Based Learning:** Learners explore and discover new information by asking questions and investigating.
- **Problem-Based Learning:** Learners are given real-world problems to solve and must use critical thinking and problem-solving skills.
- **Project-Based Learning:** Learners work on long-term projects that relate to real-world scenarios.
- **Flipped Classroom:** Learners watch lectures or instructional videos at home and complete assignments and activities in class.
- **Mastery-Based Learning:** Learners learn at their own pace and only move on to new material once they have mastered the current material.
- **Gamification:** Learning is turned into a game-like experience with points, rewards, and competition.

These strategies provide learners with opportunities to engage with the material in meaningful ways and develop important skills such as critical thinking, problem-solving, collaboration, and communication. By incorporating these strategies into their teaching, teachers can help learners develop a deeper understanding of the material and prepare them for success in the real world. Effective communication is essential for learning in the classroom. Teachers must manage talk to ensure that learners are engaged in learning and on-task. Strategies such as structuring

talk for learning, using Diamond Nine activities, and implementing group work/ collaborative learning can help teachers manage talk effectively and promote student learning and engagement. By implementing these strategies, teachers can create a positive and productive learning environment where all learners can succeed.

Universal Design for Learning (UDL) in the SHS Curriculum

The design of the curriculum uses UDL to ensure the creation of flexible learning environments that can accommodate a wide range of learner abilities, needs, and preferences. The curriculum is designed to provide multiple means of engagement, representation, and action and expression, so teachers can create a more inclusive and effective learning experience for all learners. UDL is beneficial for all learners, but it is particularly beneficial for learners needing special support and learners who may struggle with traditional teaching approaches. The integration of UDL in the pedagogy is aimed at making learning accessible to everyone and helping all learners reach their full potential. For instance, teachers need to:

- incorporate multiple means of representation into their pedagogy, such as using different types of media and materials to present information.
- provide learners with multiple means of action and expression, such as giving them options for how they can demonstrate their learning.
- consider incorporating multiple means of engagement into their choice of pedagogy, such as incorporating games or interactive activities to make learning more fun and engaging.

By doing these, teachers can help ensure that the curriculum is accessible and effective for all learners, regardless of their individual needs and abilities.

Curriculum and Assessment Design: Revised Bloom's Taxonomy and Webb's Depth of Knowledge

The design of this curriculum uses the revised Bloom's Taxonomy and Webb's Depth of Knowledge (DoK) as frameworks to design what to teach and assess.

The Revised Bloom's Taxonomy provides a framework for designing effective learning experiences. Understanding the different levels of learning, informed the creation of activities and assessments that challenge learners at the appropriate level and help them progress to higher levels of thinking. Additionally, the framework emphasises the importance of higher-order thinking skills, such as analysis, evaluation, and creation, which are essential for success in today's complex and rapidly changing world. This framework is a valuable tool for educators who want to design effective learning experiences that challenge students at the appropriate level and help them develop higher-order thinking skills. By understanding the six levels of learning and incorporating them into their teaching, educators can help prepare students for success in the 21st century. The six hierarchical levels of the revised Bloom's Taxonomy are:

1. **Remember** – At the foundation is learners' ability to remember. That is retrieving knowledge from long-term memory. This level requires learners to recall concepts—identify, recall, and retrieve information. Remembering is comprised of identifying, listing, and describing. Retrieving relevant knowledge from long-term memory includes, recognising, and recalling is critical for this level.
2. **Understand** – At understanding, learners are required to construct meaning that can be shown through clarification, paraphrasing, representing, comparing, contrasting and the ability to predict. This level requires interpretation, demonstration, and classification. Learners explain and interpret concepts at this level.
3. **Apply** – This level requires learners' ability to carry out procedures at the right time in a given situation. This level requires the application of knowledge to novel situations as well as executing, implementing, and solving problems. To apply, learners must solve multi-step problems.
4. **Analyse** – The ability to break things down into their parts and determine relationships between those parts and being able to tell the difference between what is relevant and irrelevant. At this level, information is deconstructed, and its relationships are understood. Comparing and contrasting information and organising it is key. Breaking material into its constituent parts and detecting how the parts relate to one another and an overall structure or purpose is required. The analysis also includes differentiating, organising and attributing.
5. **Evaluate** – The ability to make judgments based on criteria. To check whether there are fallacies and inconsistencies. This level involves information evaluation, critique, examination, and formulation of hypotheses.
6. **Create** – The ability to design a project or an experiment. To create, entails learners bringing something new. This level requires generating information—planning, designing, and constructing.

Webb's Depth of Knowledge (DoK) is a framework that helps educators and learners understand the level of cognitive engagement required for different types of learning tasks. The framework includes four levels. By understanding the four DoK levels, educators can design learning activities that challenge students to engage in deeper thinking and problem-solving. DoK is an essential tool for designing effective instruction and assessments. By understanding the different levels of DoK, teachers can design instruction and assessments that align with what they intend to achieve. DoK is a useful tool for differentiating instruction and providing appropriate challenges for all learners. Teachers can use DOK to identify students who need additional support or those who are ready for more advanced tasks. The four levels of Webb's' DoK assessment framework are:

- **Level 1: Recall and Reproduction –** Assessment at this level is on recall of facts, concepts, information, and procedures—this involves basic knowledge acquisition. Learners are asked specific questions to launch activities, exercises, and assessments. The assessment is focused on recollection and reproduction.
- **Level 2: Skills of Conceptual Understanding –** Assessment at this level goes beyond simple recall to include making connections between pieces of information. The learner's application of skills and concepts is assessed. The assessment task is focused more on the use of information to solve multi-step problems. A learner is required to make decisions about how to apply facts and details provided to them.
- **Level 3: Strategic Reasoning** – At this level, the learner's strategic thinking and reasoning which is abstract and complex is assessed. The assessment task requires learners to analyse and evaluate composite real-world problems with predictable outcomes. A learner must apply logic, employ problem-solving strategies, and use skills from multiple subject areas to generate solutions. Multitasking is expected of learners at this level.
- **Level 4: Extended Critical Thinking and Reasoning –** At this level of assessment, the learner's extended thinking to solve complex and authentic problems with unpredictable outcomes is the goal. The learner must be able to strategically analyse, investigate, and reflect while working to solve a problem, or changing their approach to accommodate new information. The assessment requires sophisticated and creative thinking. As part of this assessment, the learner must know how to evaluate their progress and determine whether they are on track to a feasible solution for themselves.

The main distinction between these two conceptual frameworks is what is measured. The revised Bloom's Taxonomy assesses the cognitive level that learners must demonstrate as evidence that a learning experience occurred. The DoK, on the other hand, is focused on the context—the scenario, setting, or situation—in which learners should express their learning. In this curriculum, the revised Bloom's taxonomy guided the design, and the DoK is used to guide the assessment of learning. The taxonomy provides the instructional framework, and the DoK analyses the assignment specifics. It is important to note that Bloom's Taxonomy requires learners to master the lower levels before progressing to the next. So, suppose the goal is to apply a mathematical formula. In that case, they must first be able to identify that formula and its primary purpose (remember and understand). The cognitive rigour is therefore presented in incremental steps to demonstrate the learning progression. When measuring assessments in DoK, learners move fluidly through all levels. In the same example, while solving a problem with a formula, learners recall the formula (DoK 1) to solve the problem (DoK 2 and DoK 3). Depending on the difficulty of the problem to be solved, the learner may progress to DoK 4.

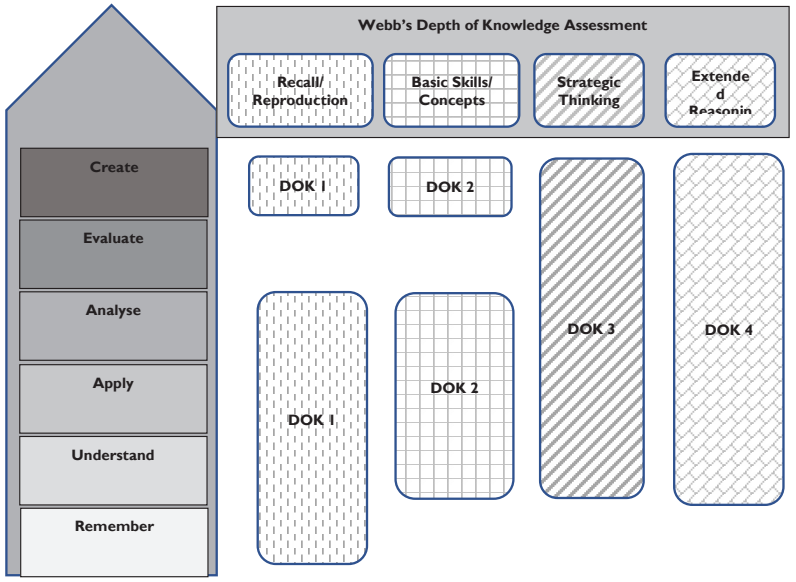

Figure 1: Revised Bloom Taxonomy combined with Webb's Depth of Knowledge for Teaching and Assessment

The structure of teaching and the assessment should align with the six levels of Bloom's knowledge hierarchy and DoK shown in Figure 1. Each level of DoK should be used to assess specific domains of Bloom's Taxonomy as illustrated in the table below:

Depth of Knowledge (DoK) Assessment	Bloom's Taxonomy applied to DoK
• Level 1: Recall and Reproduction	• Remembering, Understanding, Application, Analysis and Creation
• Level 2: Basic Skills and Concepts	• Understanding, Application, Analysis and Creation
• Level 3: Strategic Thinking	• Understanding, Application, Analysis, Evaluation and Creation
• Level 4: Extended Reasoning	• Understanding, Application, Analysis, Evaluation and Creation

In line with the National Pre-Tertiary Learning and Assessment Framework, the Secondary Education Assessment Guide (SEAG) requires that classroom assessments should cover **Assessment as learning (AaL), Assessment of learning (AoL) and Assessment for learning (AfL).** Therefore, teachers should align the Revised Bloom's Taxonomy with the DoK framework of assessment. Formative assessments should include classroom discussions, project-based assignments, and self-reflection exercises, while summative assessments should include standardised tests and rubric-based evaluations of learners' work. It is important to seek feedback from learners themselves, as they may have unique insights into how well they are developing these skills in the classroom.

To assess 21st Century skills and competencies in the classroom, teachers will have to use a combination of both formative and summative assessments to evaluate learners' acquisition of these skills and competencies. For instance:

- Identify the specific 21st Century skills and competencies to be assessed. For instance, you might want to assess *critical thinking, problem-solving, or creativity*.
- Align the skills and competencies with the DoK levels. For example, lower DoK levels might be more appropriate for assessing basic knowledge and comprehension, whereas higher DoK levels might be more appropriate for assessing more complex skills such as *analysis, synthesis, and evaluation*.
- Develop assessment items that align with the DoK levels and the skills and competencies you want to assess. These items should be designed to elicit evidence of learning across the different levels of the DoK framework.
- Administer the assessment and collect data. Analyse the data to gain insights into student learning and identify areas where learners may need additional support or instruction.

The DoK framework is a powerful tool for assessing the acquisition of 21st Century skills and competencies in the classroom, helping teachers to better understand how learners are learning and identify areas for improvement.

Educational success is no longer about producing content knowledge, but rather about extrapolating from what we know and applying the knowledge creatively in new situations.

The overall assessment of learning at SHS should be aligned with the National Pre-Tertiary Learning and Assessment Framework and the Secondary Education Assessment Guide. Formative and summative assessment strategies must be used.

Definition of Key Terms and Concepts in the Curriculum

- **Learning Outcomes:** It is a statement that defines the knowledge, skills, and abilities that learners should possess and be able to demonstrate after completing a learning experience. They are specific, measurable, attainable, and aligned with the content standards of the curriculum. It helps the teachers to determine what to teach, how to teach, and how to assess learning. Also, it communicates expectations to learners and helps them to better master the subject.
- **Learning Indicators:** They are measures that allow teachers to observe progress in the development of capacities and skills. They provide a simple and reliable means to evaluate the quality and efficacy of teaching practices, content delivery, and attainment of learning outcomes.
- **Content Standards:** It is a statement that defines the knowledge, skills, and understanding that learners are expected to learn in a particular subject area or grade level. They provide a clear target for learners and teachers and help focus resources on learner achievement.
- **Pedagogical Exemplars:** They are teaching examples used to convey values and standards to learners. Pedagogical Exemplars are usually demonstrated through teacher behaviour.
- **Assessment:** It is the systematic collection and analysis of data about learners' learning to improve the learning process or make a judgement on learner achievement levels. Assessment is aimed at developing a deep understanding of what learners know, understand, and can do with their knowledge because of their educational experiences. Assessment involves the use of empirical data on learners' learning to improve learning. Assessment is an essential aspect of the teaching and learning process in education, which enables teachers to assess the effectiveness of their teaching by linking learner performance to specific learning outcomes.
- **Teaching and Learning Resources:** Teaching and learning resources are essential tools for teachers to provide high-quality education to their learners. These resources can take various forms, including textbooks, audiovisual materials, online resources, and educational software. It is also important to avoid stereotypes and use inclusive language in teaching and learning resources. This means avoiding language that reinforces negative stereotypes and using language that is respectful and inclusive of all individuals regardless of their background. Using a consistent tone, style, and design is very important.

PHILOSOPHY, VISION AND GOAL OF APPLIED TECHNOLOGY

Philosophy

The present and future generations of learners will apply technology to solve problems in their environment through creativity and innovative application of concepts for the production of artefacts. This will be done through the support of skilled and innovative teachers who are to prepare learners for life-long learning as well as introducing them to the world of work and adult life.

Vision

Equips the learners with 21st century skills: critical thinking, creativity, collaborations and innovation as well as good citizenship and competencies to identify increasingly complex societal problems and use appropriate technological skills to solve them. Thus, it prepares learners for life-long learning and introduces them to world of work and adult life.

Goal

Goal of the Applied Technology curriculum is aimed at developing individuals to become creative, innovative, technologically inclined, digital literates and problem solvers. They should have the ability to think critically and equipped to communicate with fluency in written and spoken language, have both the confidence and competence to participate fully in Ghanaian society as responsible local and global citizens.

Contextual Issues

Context	Barriers	Addresses / Opportunities
Gender	Perception of the society is that 'technical' education is not for women.	· Successful technical women role models should be used as resource persons · Use gender sensitive pedagogies
Culture	Misconception that technical programmes are meant for the academically weak students	· Technical curriculum should be made suitable for all senior secondary school students. · Pedagogy should cater for the highly proficient, proficient and the approaching proficiency
Conceptual	Teachers tend to work more with concepts, theories and principles than they do with practical application. This does not promote creativity, collaboration and innovation.	· More practical pedagogies would be employed.
Economics / Infrastructure	Inadequate technical tools, resources and equipment at secondary schools, makes teaching of the subject difficult.	· Teachers should improvise teaching and learning resources to facilitate their work. E.g., Use local industries, field trip, simulation, YOUTUBE videos

Rationale

Applied Technology education programme introduces the youth to appropriate skills, abilities and competencies as necessary tools for the individual to live in, adapt to the real work situation and contribute to the development of society. Applied technology education is the preparation of individuals to acquire basic scientific knowledge as well as practical skills. It further provides basis for the development of skilled manpower for the world of work. This helps in increasing the work force in the country as the youth are equipped with knowledge, aptitude and trained workable practical skills and competencies required in specific occupations.

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SCOPE AND SEQUENCE

Applied Technology Summary

S/N	STRAND	SUB-STRAND			
			YEAR 1		
			CS	**LO**	**LI**
1.	Automotive Technology	Introduction to Engine Technology	1	1	3
		Introduction to Vehicle Technology	1	1	3
2	Building Construction Technology	Pre –Construction Activities	2	2	7
		Substructure and Superstructure	-	-	-
3	Electrical And Electronics Technology	Electrical Systems Design	1	1	3
		Electronic Devices and Circuits	1	1	3
4	Metal Technology	Engineering Materials, Tools and Machines	1	1	3
		Welding Technology	1	1	4
5	Woodwork Technology	Tools and Machines in Woodwork	1	1	1
		Materials and Artifact Production in Ghana	2	2	5
Total			**11**	**11**	**32**

Overall Totals (SHS 1)

Content Standards	11
Learning Outcomes	11
Learning Indicators	32

Year Two and Three Scope and Sequence

Applied Technology Summary – Automobile and Metal Technology (Option One)

S/N	STRAND	SUB-STRAND	YEAR 2			YEAR 3		
			CS	**LO**	**LI**	**CS**	**LO**	**LI**
1.	Automotive Technology	Introduction to Engine Technology	1	1	6	1	1	6
		Introduction to Vehicle Technology	1	1	6	1	1	6
2	Metal Technology	Engineering Materials, Tools and Machines	1	1	6	1	1	6
		Welding Technology	1	1	6	1	1	6
Total			**4**	**4**	**24**	**4**	**4**	**24**

Overall Totals (SHS 2 – 3)

Content Standards	8
Learning Outcomes	8
Learning Indicators	48

Applied Technology Summary – Building Construction and Wood Technology (Option Two)

S/N	STRAND	SUB-STRAND	YEAR 2			YEAR 3		
			CS	LO	LI	CS	LO	LI
1.	Building Construction Technology	Pre –Construction Activities	-	-	-	-	-	-
2.		Substructure and Superstructure	2	2	12	2	2	12
3.	Woodwork Technology	Tools and Machines in Woodwork	1	1	4	1	1	3
		Materials and Artifact Production in Ghana	2	2	8	2	1	10
Total			**5**	**5**	**24**	**5**	**4**	**25**

Overall Totals (SHS 1 – 3

Content Standards	10
Learning Outcomes	9
Learning Indicators	49

Applied Technology Summary – Electrical and Electronic Technology (Option Three)

S/N	STRAND	SUB-STRAND	YEAR 2			YEAR 3		
			CS	LO	LI	CS	LO	LI
1.	Electrical And Electronics Technology	Electrical Systems Design	1	1	12	1	1	12
		Electronic Devices and Circuits	1	1	12	1	1	12
Total			2	2	24	2	2	24

Overall Totals (SHS 1 – 3)

Content Standards	4
Learning Outcomes	4
Learning Indicators	48

YEAR ONE

Subject APPLIED TECHNOLOGY
Strand 1. AUTOMOTIVE TECHNOLOGY
Sub-Strand 1. INTRODUCTION TO ENGINE TECHNOLOGY

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
1.1.1L.O.1		
Analyse and use relevant principles underlying engines to service, and repair spark ignition (SI) and compression ignition (CI) engines	**Communication and collaboration skills:** • As learners work in groups they listen to peers and ask relevant questions based on what they heard. • Learning from and contributing to the learning of others. • Able to adapt their presentation to better engage the audience during its delivery. • Able to identify and analyse different points of view they hear in a discussion and explain how they are different. **Critical thinking and Problem-solving skills:** • Ability to use justifiable principles to choose between the types that they have identified. • Apply knowledge to real life workings in the use of engines. • Able to identify and analyse different points of view they hear in a discussion and explain how they are different. • Apply their knowledge or make connections with what they learn in real life situations.	**GESI:** Learners having experienced a teaching approach that ensures gender equality and social inclusion, where they work with each other in an inclusive way; cross-sharing knowledge and understanding among groups and individuals lead them to: • Examine and dispel misconceptions/ myths about gender as they relate to technical education • Interrogate their stereotypes and biases about gender and the role men and women play in technical education • Sensitive to the interrelatedness of the various aspects of engine systems. • Value and promote health and safety in workshop and in society. **SEL:** All learning experiences related to engine technology should give learners the opportunities to develop the social emotional learning competencies, which include self-awareness, self-management, social awareness, relationship skills, and responsible decision-making. The teacher should implement the social emotional learning strategies to make sure that learners achieve each learning outcome in the engine technology and be

		• Reflecting about oneself and gaining confidence • Exhibiting motivation and SMART goal setting • Managing feelings, emotions and conflicts • Showing empathy and cooperation The following strategies may be adopted by the teacher in achieving SEL • modelling emotional self-control and judgment • promotion of positive self-talk with self-made portraits of engineering practices • making of a vision board, coming up with respectful conversation starters for healthy debates • Encourage learners to write about the sequence of their activities and diversity presentations. **National Values**: • Fairness, accountability, integrity, hard work, tolerance and respect for other

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
1.1.1.CS.1	1.1.1.LI.1	1.1.1.AS.1
Demonstrate the knowledge and application of the working principles of engines	**Identify types of engines and describe the main component of the engine** **Group work/Collaborative Learning:** Group students and let them discuss and tolerate the views of others on the various types of engines used in vehicles and observe critically with passion the differences between the features of petrol and diesel engines and state the functions of the engine.	Level 1 Recall **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
	1.1.1.LI.2	1.1.1.AS.2
	Explain the constructional and operational differences between petrol and diesel engines **Problem based Learning:** Display a dismantled engine for the learners to identify the various components and their precise positions in the spark ignition (SI) and compression ignition (CI) engines.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	1.1.1.LI.3	1.1.1.AS.3
	Demonstrate safety measures applied to servicing, repair and maintenance of engine systems **Project-based Learning:** Watch safety videos effectively, guide students to brainstorming the various ways to ensure workshop, personal, customer and vehicle safety in an efficient servicing and repairs and present report	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
Teaching and Learning Materials	• Models of engines • Petrol and diesel engines • Charts/sketches • Video/YouTube • Real engines • Local vehicle repair workshop • Simulated activities • Real objects • Models	

Subject APPLIED TECHNOLOGY
Strand 1. AUTOMOTIVE TECHNOLOGY
Sub-Strand 2. INTRODUCTION TO VEHICLE TECHNOLOGY

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
1.1.2.LO.1		
Detect problems in the vehicle transmission and braking system	**Communication and Collaboration skills:** • As learners work in groups, they will exhibit ability to identify and analyse different points of view they hear in a discussion and explain how they are different. • Able to follow and take part in a group discussion and express opinions when called upon. • Understand other people's perspectives and prepare them to function better in real-life social and work situation. **Critical thinking and problem-solving skills:** • Ability to seek additional information to build understanding will be applied in brainstorming activities. • Thinking rationally and clearly to solve problems. • Able to identify and analyse different points of view they hear in a discussion and explain how they are different	**GESI:** Learners having experienced a teaching approach that ensures gender equality and social inclusion, where they work with each other in an inclusive way; cross-sharing knowledge and understanding among groups and individuals lead them to: • Examine and dispel misconceptions/ myths about gender as they relate to technical education • Interrogate their stereotypes and biases about gender and the role men and women play in technical education • Sensitive to the inter-relatedness of the various aspects of vehicle systems. • Value and promote health and safety in workshop and in society. **SEL:** All learning experiences related to vehicle technology should give learners the opportunities to develop the social emotional learning competencies, which include self-awareness, self-management, social awareness, relationship skills, and responsible decision-making. The teacher should implement the social emotional learning strategies to make sure that learners achieve each learning outcome in the vehicle technology and be • Reflecting about oneself and gaining confidence

		• Exhibiting motivation and SMART goal setting • Managing feelings, emotions and conflicts • Showing empathy and cooperation The following strategies may be adopted by the teacher in achieving SEL • modelling emotional self-control and judgment • promotion of positive self-talk with self-made portraits of engineering practices • making of a vision board, coming up with respectful conversation starters for healthy debates • Encourage learners to write about the sequence of their activities and diversity presentations. **National Values**: • Fairness, tolerance, respect for others and pursuit of excellence.

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
1.1.2.CS.1	1.1.2.LI.1	1.1.2.AS.1
Demonstrate knowledge and understanding of vehicle technology subsystems	**Identify the components of vehicle transmission system and explain their functions** **Group work/collaborative learning:** Learners in mixed ability groups are given charts and guidelines to fairly brainstorm to identify types of transmission systems used in vehicles such as manual and automatic transmission as well as the layout of the conventional transmission system **Experiential learning:** educational visit to local vehicle repair workshop where functions of transmission system components are explained to the students for efficient understanding	Level 1 Recall **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
	1.1.2.LI.2	1.1.2.AS.2
	Evaluate the components of braking system and state their functions **Research and Collaborative Learning:** • Learners brainstorm with respect for others to share ideas on how a moving vehicle stops or slows down and the principles behind it. • Guide learners to effectively make reference to the components of the braking system using relevant resources such as models and sketches /charts.	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	1.1.2.LI.3	1.1.2.AS.3
	Differentiate between mechanical, hydraulic and pneumatic braking systems **Group work/collaborative learning:** Learner's brainstorm and tolerate the with views of others to share ideas on how a moving vehicle stops or slows down and the principles behind it. **Talk for learning approaches:** Assist learners to make appropriate references to models for actuating the brakes effectively. Show videos on the three ways (mechanical, hydraulic and pneumatic) of operating the vehicle brakes and learners discuss among the mixed ability groups how it works.	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**

Teaching and Learning Materials	• Sketches/charts • real vehicle transmission lines	• Models • Models on braking system	• real object • charts

Subject APPLIED TECHNOLOGY
Strand 2. BUILDING CONSTRUCTION TECHNOLOGY
Sub-Strand 1. PRE-CONSTRUCTION ACTIVITIES

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
1.2.1.LO.1		
Demonstrate Knowledge of Human resource requirements in Building construction.	**Collaboration skills:** All Learners will rely on the knowledge of one another to explain the difference between Stakeholders and Professionals involved in construction projects as well as their roles.	**GESI:** Teaching strategies that ensure social inclusion, social justice and gender equality have been experienced by the learners through working together, sharing ideas and expressing themselves in groups and individually. Through GESI learners are able to: • appreciate religious and, socio-economic differences. • Accept diversity of opinions • Regard the equal opportunities given to them • Identify injustice meted out to them and boldly speak against it when it comes to, for instance, dealing with bullies that may find their way into group discussions or on Field Trips who may attempt to deny them opportunities in participation. • Recognize individual differences and accept them as such • Get rid of biases against gender or learners approaching proficiency • Express their views and opinions freely without fear • Encourage the marginalized to express their views and opinions freely without hesitations nor fear.

		SEL: Creating opportunities for learners to build their Social Emotional Learning Competencies - *Self-Awareness, Self-Management, Social Awareness, Relationship Skills and Responsible Decisions* are integrated throughout all lessons to encourage inclusion. As part of achieving each learning outcome in the curriculum, the teacher should apply the SEL strategies by promoting self-regulation, decision making and positive self-talk etc. to ensure that learners are: • Self-reflecting and finding confidence when given the opportunity to communicate or show collaborative skills as all learners in various groups contribute what they know about foundations. • Exhibiting motivation, and SMART goal setting • Managing emotions and conflicts as participations at group discussions can turn argumentative and frustrating. • Showing empathy and cooperation to colleagues that may not have been to any construction site before to take the time to understand issues regarding Foundations. **National Core Values**: Tolerance, friendliness, open mindedness, patience, hard work, humility, precision, accuracy, fairness, accountability, integrity and respect for others

1.2.1.LO.2		
Analyse mobilisation and determine the schedule of works involved in site preparation.eg clearing, hoarding, provision of services, establishing temporal structures and roads for mobilization to complete.	**Communication:** All Learners will apply their communication skills through oral and/ or written presentations to explain reasons for mobilization. **Collaboration:** • All Learners will rely on the knowledge of one another in describing Clearing and hoarding of Site to facilitate construction works. • All Learners will participate in discussing the locations of temporal structures, Services, welfare facilities and Equipment at new construction Sites in order to ensure safety, order, progress of work and Security**.**	**GESI:** Having benefited from pedagogical approaches which enhanced tremendous gender equality and social inclusion, be it at individual levels or group levels Learners would be expected to: • Show respect for the views and needs of individuals of different gender and backgrounds, especially when it comes to allocating spaces for changing rooms and places of convenience. • Acknowledge diversity and practice inclusion. • Dispel misconceptions/ myths about gender as they relate to one another especially within the Construction team which most practitioners thought was a preserve for men. **SEL:** Creating opportunities for learners to build their Social Emotional Learning Competencies - *Self-Awareness, Self-Management, Social Awareness, Relationship Skills and Responsible Decisions* are integrated throughout all lessons to encourage inclusion. As part of achieving each learning outcome in the curriculum, the teacher should apply the SEL strategies by promoting self-regulation, decision making and positive self-talk etc. to ensure that learners are:

		• Self-reflecting in gathering knowledge and finding confidence to stand firm on the side of good principles. • Exhibiting motivation, and SMART goal setting • Managing emotions and conflicts • Showing empathy and cooperation as they for instance Take responsible decisions to safeguard personal safety and safety of others working at the site as well as ensure harmony by allocating equally to all spaces within the welfare facilities. **National Values:** Cooperation, Commitment, Integrity, Honesty, Equality, Sincerity, Tolerance, Friendliness, Open mindedness, Hard work, Humility and Ethics.

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
1.2.1.CS.1	1.2.1.LI.1	1.2.1.AS.1
Demonstrate Knowledge and understanding of the roles and responsibilities of various Building construction Personnel.	**Explain the stakeholders involved in building construction project** **Collaboration** • (Identification of ability and positioning to ensure mixed ability) • Through mixed-ability grouping learners will outline the stakeholders involved in building construction project. This method is to enhance effective participation in teaching and learning by different learners including the Approaching Proficiency, Proficiency and Highly Proficient. **Collaboration** • (Identification of ability and positioning to ensure mixed ability) • Through mixed-ability grouping learners will explain the stakeholders involved in building construction project. This method is to enhance effective participation in teaching and learning by different learners including the Approaching Proficiency, Proficiency and Highly Proficient.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	1.2.1.LI.2	1.2.1.AS.2
	Describe the roles of stakeholders in building construction project **Collaboration** • Through structured grouping (GESI) ask learners to describe the roles of stakeholders in building construction project. This approach is to ensure effective participation in teaching and learning by different categories of learners including Approaching Proficiency, the Proficient and the Highly Proficient.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	1.2.1.LI.3	1.2.1.AS.3
	Identify the Professionals involved in building construction project **Collaboration** • Through structured grouping (GESI) ask learners to outline the Professionals involved in building construction project. This method is to ensure effective participation and	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning**

	learning by different categories of learners including Approaching Proficiency, the Proficient and the Highly Proficient. • Through Mixed-Ability grouping ask learners to explain the Professionals involved in building Construction Projects.	Level 4 Extended critical thinking and reasoning
	1.2.1.LI.4	1.2.1.AS.4
	Describe the roles of Professionals in building Construction Projects. **Collaboration** • Through structured grouping (GESI) ask learners to describe the roles of Professionals involved in building construction project. This method is to ensure effective participation and learning by different categories of learners including Approaching Proficiency, the Proficient and the Highly Proficient. **Experiential Learning:** Embark on field trips to the work places of Professionals such as Architects, Quantity Surveyors, Structural Engineers, Electrical Engineers, Mechanical Engineers as well as Contractors with the agenda of having Learners interact, discuss and obtain information on issues such as; 1. Categories of Service they provide in the Building Construction Industry. 2. Type of training. 3. Benefits and Challenges encountered.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
Teaching and Learning Materials	Surfing on the Internet Learners will find; • the difference between Stakeholders and Professionals involved in construction projects and roles played by Stakeholders and Professionals in the procurement of construction projects.	

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
1.2.1.CS.2	1.2.1.LI.1	1.2.1.AS.1
Demonstrate Knowledge and understanding of Mobilisation for Building Construction.	**Discuss the reasons for mobilisation** **Communication:** organise a whole class and let learners explain the meaning of mobilization and discuss appropriately the reasons for mobilization. This is a brainstorming method that involves critical thinking among Learners as they sincerely discuss and find reasons for Mobilizations. **Collaboration:** Ask learners in mixed ability groups to engage in brainstorming over Mobilization and verify the major processes involved in the task. Exemplars; 1. Using excavators to clear site (mechanical means), 2. Using sheets of metal, plywood and chain links as hoarding to prevent trespassing by unauthorised persons and to protect the works. 3. The use of Site Lay-out plans for location of Security, Services, Warehouses, Offices, Welfare Facilities	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	1.2.1.LI.2	1.2.1.AS.2
	Differentiate Clearly between site preparations and hoarding of Site to facilitate constructional works. **Communication:** Organise a whole class and let learners distinguish between site preparation and hoarding of Site prior to the start of constructional works. This is a brainstorming method that involves critical thinking among Learners as they sincerely discuss and find the differences between site preparations and hoarding of site. **Collaboration:** Ask learners in mixed ability groups to differentiate clearly between site preparations and hoarding of site. This method is to facilitate effective participation by different Learners, namely, the Approaching Proficiency, the Proficient and the Highly Proficient Exemplars; 1. Using excavators to clear site (mechanical means), 2. Using sheets of metal, plywood and chain links as hoarding to prevent trespassing by unauthorised persons and to protect the works.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning

	3. The use of Site Lay-out plans for location of Security, Services, Warehouses, Offices, Welfare Facilities	
	1.2.1.LI.3	1.2.1.AS.3
	Explain how the locations of temporal structures are specified, as well locations of Services, welfare facilities and Equipment at the new construction Site to ensure order, safety, progress of work and Security. **Communication:** organize a whole class and let learners explain temporal structures, Welfare Facilities, temporal services and plants that will be required at site and verify the major roles of these Items at the site. This is a brainstorming method that involves critical thinking among Learners as they sincerely discuss and find reasons for having such items at the site. **Collaboration** • Identification of ability and positioning to ensure mixed ability. • Through structured grouping [GESI] ask Learners to explain the arrangement of temporal structures, services and plant at site in such a way so as to ensure safety, efficiency and security. This method is to ensure effective participation in teaching and learning by different categories of Learners including Approaching Proficiency, the Proficient and the Highly Proficient. Exemplars; 1. Using excavators to clear site (mechanical means), 2. Using sheets of metal, plywood and chain links as hoarding to prevent trespassing by unauthorised persons and to protect the works. 3. The use of Site Lay-out plans for location of Security, temporal Services, Warehouses, Offices, Welfare Facilities. **Experiential Learning:** Embark on field trips to construction sites to help Learners observe and take note of the following; 1. Layout of the site indicating the building under construction, security, store, workshops administration, workers' welfare facilities, fuel depot etc. 2. Activities that take place in these temporal structures and how they support constructional works. 3. Fencing used as hoarding and its usefulness for security etc. 4. The usual open space round the building under construction and its usefulness in ensuring movement etc.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning

Teaching and Learning Materials	• Surfing on the Internet to find the reasons for mobilisation for different projects at different sites. • The use of simulation (virtual) to illustrate Site preparations and Hoarding of Site. • The use of Flip Charts with Site Lay-Out Plans to indicate the locations of the temporal structures, Equipment Services and Welfare Facilities.

Subject APPLIED TECHNOLOGY
Strand 3. ELECTRICAL AND ELECTRONIC TECHNOLOGY
Sub-Strand 1. ELECTRICAL SYSTEMS DESIGN

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
1.3.1.LO.1		
Outline clearly, safety principles to follow in the use of electricity; analyse the key steps in power transmission and link it to power distribution to other substations, homes and industries.	**Communication Skills** • Learners work in groups thus enabling them to become capable of listening and participating in a group discussion, as well as being able to express themselves well when the need arises • Group work enables learners to demonstrate the ability to identify and analyse different points of view they hear in a discussion and explain how they differ. **Collaboration Skills** • Learners appreciate the views of others. This prepares them to function more effectively in all social settings **Critical Thinking skills** • The use of brainstorming enables learners to develop the ability to think critically and seek additional information in order to improve their understanding of issues. Thus, they are able to make meaningful contribution to national development. **Problem Solving Skills** • Learners develop the ability think rationally when confronted with a situation thus enabling them to find solutions to any situation that confronts them. • Capable of identifying and analysing different situations. This makes them able to solve real life situations	**GESI:** The classroom is always made up of learners of various backgrounds with unique needs and challenges. It is therefore very important to ensure that all teaching and learning approaches promote gender equality and social inclusion. Learners who experience such approaches are more likely to: • Value and respect individuals of different backgrounds in order to understand them when they make different choices during analysis of electrical issues. • Be gender sensitive and so value and appreciate the diverse roles played by men, women and persons with special needs during electrical works that demand physical activities e.g. Poles/pylons climbing as well as dismantling of electrical machines. • Appreciate diversity and practice inclusion by involving all in electrical works. **SEL:** The instructional methods used to ensure social inclusion, social justice, and emotional control have been introduced to the students. Learning through SEL allows students to • make decisions and adhere to safety precautions when working with electricity. • be aware of his/her strength and weaknesses as far as the learning of power transmission and distribution is concerned

	Digital Literacy • Learners can do presentations using power point • Learners will be capableof using ICT to access Open Educational Resources on the internet (OERs). **Personal development skills:** • While working with others, learners will develop personal and interpersonal skills such as self-confidence, respect, honesty and self-reliance. This will enable them take responsibility for their own learning. **Leadership skills** • Learners will be able to articulate views and express themselves while working with others. With some elected as leaders, leadership skills are developed. This enables them take up leadership roles in future **Creativity and Innovation skills:** • Learners can interpret ideas and innovatively convey same to other • Given an initial idea, learners can generate their own ideas. This serves as a foundation for design and creativity solve problems in the future	• be able to relate to other learners when group assignments are given. • be able to manage his /her time very well when given individual assignment. **National Core Values** For a nation to move forward, its citizens must cultivate certain values which will drive the nation's wheels of progress. Values such as patriotism, honesty, sense of responsibility and hard work are required particularly with skilled personnel in order to ensure progress and growth in industries. Learners are therefore expected to: • adhere to rules and regulations when dealing with electricity to prevent electrocution • exhibit sense of responsibility in the care and maintenance of tools and equipment in the workshop. • be patriotic enough to avoid illegal connection in power distribution.

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
1.3.1.CS.1	1.3.1.LI.1	1.3.1.AS.1
Demonstrate knowledge and understanding of power transmission and distribution and its associated safety	**Discuss safety in the use of electricity.** **Problem based and Collaborative Learning:** Place learners in mixed ability or mixed gender manageable group sizes to brainstorm the meaning, causes and effects of electric shock. **Experiential Learning/collaborative learning:** Engage learners to role play how a victim of electric shock should be treated and task them to identify precautions to be observed when working with electricity e.g.: always switch off circuits before working. **NB:** 1. learners with special needs should be given more time to complete a given task. 2. During presentations, ensure that anyone regardless of the background i.e., Sex, physical abilities and intellectual abilities be encouraged to present on behalf of the groups as well as becoming a group leader.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
	1.3.1.LI.2	1.3.1.AS.2
	Describe the process of electrical Power Transmission and distribution. **Experiential Learning and Collaborative Learning:** • Engage learners in mixed ability groupings and use the Google search Engine and the YouTube to undertake the following activities and do group presentation on their findings: List typical transmission voltages e.g., 132kv, 275kv, 400kv and distribution voltages in Ghana and state the application of each e.g., 33KV, 11KV, 415/240V • State the advantages and disadvantages of High voltage transmission e.g., losses are minimized **NB:** 1. learners with special needs should be given more time to complete a given task. 2. During presentations, ensure that anyone regardless of the background i.e., gender, physical abilities or intellectual abilities is encouraged to present on behalf of the groups. 3. Any person at all can be selected as a leader of a group.	Level 1 Recall **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**

	Experiential Learning: Embark on a field trip to any of the energy providers (ECG or NEDCO) to have a look at their substations in other to: 1. Describe a distribution substation and list some equipment at the substation 2. Describe the systems of distributing power in Ghana e.g., single phase, 3-phase 3. Explain the consequences of illegal power connections cautioning leaners to be patriotic enough to avoid illegal connection. 4. List companies responsible for power transmission (e.g.,GRIDCo) and those responsible for power distribution in Ghana 5. List companies responsible for power distribution in Ghana e.g. ECG, NEDCO			
	1.3.1.LI.3			1.3.1.AS.3
	Apply the concept of power transmission and distribution in electricity supply. **Experiential Learning:** • Demonstrate using videos, the consequences of overloading the distribution network through illegal connections. • Engage learners in mixed ability or mixed gender groups to simulate power distribution and transmission networks using VPlab software and videos and present their findings. **NB:** 1. Special needs students should be given more time to finish a task. 2. During presentations, make sure that everyone is encouraged to speak on behalf of the groups, regardless of background, such as gender, physical capabilities, or intellectual ability. 3. Any individual can be chosen as the group's leader.			Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
Teaching and Learning Materials	• Overcoat • Goggles	• hand gloves • protective shoes	• fire extinguishers	• computers installed with VPLab, multism and circuit wizard software.

Subject **APPLIED TECHNOLOGY**
Strand 3. **ELECTRICAL AND ELECTRONIC TECHNOLOGY**
Sub-Strand 2. **ELECTRONIC DEVICES AND CIRCUITS**

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
1.3.2.LO.1		
Employ knowledge of the construction and operation of diodes to design and construct electronic circuits.	**Communication Skills:** • Learners work in groups thus enabling them become capable of listening and participating in a group discussion, as well as being able to express themselves well when the need arises • Group work enables learners to demonstrate the ability to identify and analyse different points of view they hear in a discussion and explain how they differ. **Collaboration Skills**: Learners appreciate the views of others. This prepares them to function more effectively in all social settings **Critical Thinking skills:** The use of brainstorming enables learners to develop the ability to think critically and seek additional information in order to improve their understanding of issues. Thus, they are able to make meaningful contribution to national development. **Problem Solving Skills:** • Learners develop the ability think rationally when confronted with a situation thus enabling them to find solutions to any situation that confronts them. • Learners will be capable of identifying and analysing different situations. This makes them able to solve real life situations	**GESI:** There are always a variety of learners in the classroom, each with their own requirements and difficulties. Therefore, it is crucial to make sure that all methods of teaching and learning encourage social inclusion and gender equality. Learners studying electronics who encounter these methods are more likely to: • Recognise and appreciate the output of each individual as they design electronic circuits to solve problems. • Be gender sensitive by exhibiting the designs of women as a way appreciating their efforts. • value and respect everyone's contribution to the design and construction of electronic circuits, especially that of the less privileged. **SEL:** Learners have been introduced to the educational strategies used to achieve social inclusion, social justice, and emotional regulation. Through SEL, Learners will be able to... • have the determination to be able to build very good electronic circuit using diodes. • be aware of his/her strength and weaknesses as far as the learning of the use diodes in designing circuits is concern.

	Digital Literacy: • Learners can do presentations using power point • Learners will be capable of using ICT to access Open Educational Resources on the internet (OERs). **Personal development skills:** While working with others, learners will develop personal and interpersonal skills such as self-confidence, respect, honesty and self-reliance. This will enable them take responsibility for their own learning. **Leadership skills:** Learners will be able to articulate views and express themselves while working with others. With some elected as leaders, leadership skills are developed. This enables them take up leadership roles in future. **Creativity and Innovation skills:** • Learners can interpret ideas and innovatively convey same to others. • Given an initial idea, learners can generate their own ideas. This serves as a foundation for design and creativity to solve problems in the future.	• relate to other learners when group assignment is given. • manage his /her time very well when given individual assignment. **National Core Values** For a nation to move forward, its citizens must cultivate certain values which will drive the nation's wheels of progress. Values such as patriotism, honesty, sense of responsibility and hard work are required particularly with skilled personnel in order to ensure progress and growth in industries. Learners are therefore expected to: • be honest in the estimation and purchasing of electronic materials for their clients. • be honest and sincerewith clients in the repairs of their electronic gadgets • exhibit some sense of responsibility when working with tools in the workshop (in terms theft).

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
1.3.2.CS.1	1.3.2.LI.1	1.3.2.AS.1
Demonstrate understanding of Diodes as electronic devices and apply them in designing electronic circuits.	**Explain the concept of electrical and electronic circuits** **Talk for learning / collaborative learning:** Engage learners in think pair share and task them to brainstorm on the meaning of electrical and electronic circuits as well as differentiate between electrical and electronic circuits.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
	1.3.2.LI.2	1.3.2.AS.2
	Describe the principles and operation of the various Diodes **Collaborative Learning/ Talk for learning and Research**: • Using mixed ability grouping, engage learners to brainstorm through research the following activities and present their findings in a group presentation: Explain the formation of the pn junction • List the types of diodes and describe the construction of each e.g. LED, Zener diode, power diode **Groupwork/Talk for learning:** • Describe the construction and operation of each diode and their operations • State the application of each type of diode. **NB:** 1. learners with special needs should be given more time to complete a given task. 2. During presentations, ensure that anyone regardless of the background i.e., Sex, physical abilities or intellectual abilities is encouraged to present on behalf of the groups. 3. Any person at all can be selected as a leader of a group.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	1.3.2.LI.3	1.3.2.AS.3
	Apply the principles of Diodes in designing circuits	**Level 1 Recall**

	Problem-Based Learning/ collaborative learning/experiential learning/ Project-based learning: **Engage learners in mixed ability groupings to**: • Test for good diodes and faulty ones and exhibit honesty in the in identifying good diodes from faulty ones. • Design and simulate using multism software, rectification circuit (half wave and full wave) using diodes, exhibiting sense of responsibility in the care of tools and equipment given them. • Using mixed ability grouping, task learners to go through the process of rectification. **Note:** Zener diode should be used to stabilise the output dc and LED to be used as an indicator. • Engage learners in mixed ability grouping to build a security circuit using photo diode and infrared diode as a project work. **NB:** The grouping based on mixed ability and mixed gender should be encouraged and those with less interest in practical activities as well as the use of computers in designing, especially the ladies, should be made leaders in the various groups.	**Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
Teaching and Learning Materials	• power diode • Zener diode • LED	• infrared diode • photo diode • signal generator	• Oscilloscope • Capacitors • computer installed with multism application

Subject APPLIED TECHNOLOGY
Strand 4. METAL TECHNOLOGY
Sub-Strand 1. ENGINEERING MATERIALS, TOOLS AND MACHINES

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
1.4.1.LO.1		
Apply health and safety to the use of tools and machines as well as use properties of metals and non-metals to select the right materials for a given application	**Communication and Collaboration skills:** • As learners work in groups, they will exhibit ability to identify and analyse different points of view they hear in a discussion and explain how they are different. • Able to follow and take part in a group discussion and express opinions when called upon. • Understand other people's perspectives and prepare them for to function better in real-life, social and work situation. **Critical thinking and problem-solving skills:** • Ability to seek additional information to build understanding will be applied in brainstorming activities. • Thinking rationally and clearly to solve problems. • Able to identify and analyse different points of view they hear in a discussion and explain how they are different	**GESI:** Learners having experienced a teaching approach that ensures gender equality and social inclusion, where they work with each other in an inclusive way; cross-sharing knowledge and understanding among groups and individuals lead them to: • Examine and dispel misconceptions/ myths about gender as they relate to technical education • Interrogate their stereotypes and biases about gender and the role men and women play in technical education • Sensitive to the inter-relatedness of the various aspects of metal work technology. • Value and promote health and safety in workshop and in society. **SEL:** All learning experiences related to metal technology should give learners the opportunities to develop the social emotional learning competencies, which include self-awareness, self-management, social awareness, relationship skills, and responsible decision-making. The teacher should implement the social emotional learning strategies to make sure that learners achieve each learning outcome in the metal technology and be • Reflecting about oneself and gaining confidence

		• Exhibiting motivation and SMART goal setting • Managing feelings, emotions and conflicts • Showing empathy and cooperation The following strategies may be adopted by the teacher in achieving SEL • modelling emotional self-control and judgment • promotion of positive self-talk with self-made portraits of engineering practices • making of a vision board, coming up with respectful conversation starters for healthy debates • Encourage learners to write about the sequence of their activities and diversity presentations. **National Values:** • Safety and welfare of the public, discipline, fairness and respect for others. • Precision, accuracy discipline, fairness, and respect for others. • fairness, integrity, hard work, tolerance, accountability and respect for other

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI				Assessment
1.4.1.CS.1	1.4.1.LI.1				1.4.1.AS.1
Demonstrate knowledge in the use of engineering materials, tools and machines	**Explain health and safety related to workshop, tools, materials and machines** **Group work/collaborative learning:** • Group students and guide them to discuss effectively with respect for others the various ways of avoiding accidents in the workshop, tools, handling materials and using machines. • Learners watch safety video to identify and use the appropriate safety clothing for workshop activities and demonstrate the right safety measures in the use of tools and machines.				Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	1.4.1.LI.2				1.4.1.AS.2
	Explain the uses of various types of measuring, marking out, holding, striking and cutting tools **Research and Collaboration:** Learners in mixed groups and in a fair manner are shown samples of measuring, marking out, holding, striking and cutting tools in metalwork and tasked to brainstorm their uses.				Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	1.4.2.LI.3				1.4.2.AS.3
	Explain ferrous and non-ferrous metals with engineering applications and state the uses of non-metallic materials. **Project-based learning:** Learners are guided to use the appropriate charts or samples of items made of ferrous and non-ferrous metals to identify and fairly discuss the various types. Assist students to discuss the properties of various ferrous and non-ferrous metals using charts or real objects and present report. Learners also brainstorm to identify products made from plastics and types of plastics as well as manufacture of plastics products.				Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
Teaching and Learning Materials	• Charts • real objects • video/YouTube	• Measuring • Cutting • marking out	• holding • striking tools • sketches/charts	• Specimen of ferrous • non-ferrous metals	

Subject APPLIED TECHNOLOGY
Strand 4. METAL TECHNOLOGY
Sub-Strand 2. WELDING TECHNOLOGY

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
1.4.2.LO.1		
Apply the principle of gas and arc welding to produce artefacts and solve problems in sheet metal and metal plate fabrication	**Communication and Collaboration skills:** • Able to adapt their presentation to better engage the audience during its delivery • Assuming shared responsibility, cooperating and giving feedback. • Able to follow and take part in a group discussion and express opinions when called upon. • Understand other people's perspectives and prepare them to function better in real-life social and work situation. **Critical thinking and problem-solving skills:** • Ability to seek additional information to build understanding will be applied in brainstorming activities. • Thinking rationally and clearly to solve problems. • Able to identify and analyse different points of view they hear in a discussion and explain how they are different	**GESI:** Learners having experienced a teaching approach that ensures gender equality and social inclusion, where they work with each other in an inclusive way; cross-sharing knowledge and understanding among groups and individuals lead them to: • Examine and dispel misconceptions/ myths about gender as they relate to technical education • Interrogate their stereotypes and biases about gender and the role men and women play in technical education • Sensitive to the inter-relatedness of the various aspects of metal work technology. • Value and promote health and safety in workshop and in society. **SEL:** All learning experiences related to welding technology should give learners the opportunities to develop the social emotional learning competencies, which include self-awareness, self-management, social awareness, relationship skills, and responsible decision-making. The teacher should implement the social emotional learning strategies to make sure that learners achieve each learning outcome in the engine technology and be

		• Reflecting about oneself and gaining confidence • Exhibiting motivation and SMART goal setting • Managing feelings, emotions and conflicts • Showing empathy and cooperation The following strategies may be adopted by the teacher in achieving SEL • modelling emotional self-control and judgment • promotion of positive self-talk with self-made portraits of engineering practices • making of a vision board, coming up with respectful conversation starters for healthy debates • Encourage learners to write about the sequence of their activities and diversity presentations. **National Values:** Discipline, fairness, precision, accuracy and respect for others.

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
1.4.2.CS.1	1.4.2.LI.1	1.4.2.AS.1
Demonstrate knowledge and understanding of tools and equipment for welding	**Identify and explain the use of various tools and equipment for gas welding** **Group work/collaborative learning:** Learners in mixed ability groups are given appropriate charts and guided to brainstorm to identify with safety guidelines the precise gas welding equipment	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	1.4.2.LI.2	1.4.2.AS.2
	Describe various tools and equipment for electric arc welding **Experiential Learning:** Learner's educational visit to local welding workshop or school workshop where the set up and the use of tools and equipment are explained to them fairly. Guide learners to make appropriate reference to the equipment of the electric arc welding using relevant resources. Learners embark on an educational visit to a local electric arc welding workshop or school workshop.	Level 1 Recall Level 2 Skills of conceptual understanding Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**
	1.4.2.LI.3	1.4.2.AS.3
	Indicate the various applications of gas and electric arc welding Organise the learners into fair mixed ability and gender inclusive groups, task them to effectively research on the specific applications where gas and electric arc welding are used. E.g. Burglar proof for windows, gates, car body repairs, local containers, metal tables and chairs etc.	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	1.4.2.LI.4	1.4.2.AS.4
	Compare the advantages and disadvantages of gas and electric arc welding **Group work/collaborative learning:** Learners brainstorm and tolerate the views of others to share ideas on advantages and disadvantages of gas and electric arc welding and present report	Level 1 Recall Level 2 Skills of conceptual understanding Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**
Teaching and Learning Materials	• Gas welding equipment set up • charts/ sketches	• Electric arc welding equipment set up • models • video/YouTube

Subject APPLIED TECHNOLOGY
Strand 5. WOODWORK TECHNOLOGY
Sub-Strand 1. TOOLS AND MACHINES IN WOODWORK INDUSTRY

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
1.5.1.LO.1		
Demonstrate knowledge and understanding in health and safety and apply the appropriate safety measures in wood working environment.	**Critical Thinking:** The brainstorming by the whole class session leads to critical thinking **Critical thinking and Problem solving, Communication, Collaboration and Leadership skills:** The group activities develop critical thinking and problem solving, literacy, communication, collaboration and leadership skills. **Critical Thinking:** The assessment level 3 facilitates Strategic Thinking/ Reasoning and assessment level 4 facilitate the development of Extended Critical Thinking	**GESI:** Having encountered gender equality and social inclusion-based teaching pedagogy, where each student is important and affected by the learning activities which reinforce knowledge and skill acquisition, it is expected that students and groups will: • Emphasize on attitudes and values that promote gender equality and social inclusion. • Balance representation of males and females and all marginalized groups in the content. • Appreciate mixed ability and socio-economic backgrounds. • Embrace differentiated teaching and assessment building on consideration of prior learning of learners. • Engaged equally regardless of their socio-economic background and religion. • Personalize and inculcate core values and skills in wood technology for personal and national development. **SEL:** Creating opportunities for learners to build their Social Emotional Learning

		Competencies - *Self-Awareness, Self-Management, Social Awareness, Relationship Skills and Responsible Decisions* are integrated throughout wood technology to encourage inclusion. The teacher should apply the social emotional learning strategies to ensure that learners are: • Building their confidence in doing things or answering questions in class • Exhibiting motivation, and SMART goal setting • Accepting themselves as they are and try to control their attitude and behavior These may be done by the teacher through modelling emotional self-regulation and decision making, and the promotion of positive self-talk with self-made portraits, creation of a vision board, creating respectful icebreaker for healthy debates, encourage diversity presentations, and learners writing on the sequence of their activities. **National Value:** Self-Control, Open-mindedness, Passion, Responsibility, Co-operation, Work Ethics, Cleanliness, Patience, Tolerance.

<table>
<tr><th>Content Standards</th><th>Learning Indicators and Pedagogical Exemplars with 21st Century and GESI</th><th>Assessment</th></tr>
<tr><td>1.5.1.CS.1</td><td>1.5.1.LI.1</td><td>1.5.1.AS.1</td></tr>
<tr><td></td><td colspan="2">Apply the appropriate safety measures in the woodwork shop

Critical Thinking and Talk for Learning Approaches
• Guide learners through whole class session to co-operatively brainstorm the meaning of health and safety in the workshop with open-mindedness.
• Assist learners through whole class session discussion to co-operatively and open-mindedness explain: a. safety precautions b. Personal safety c. Workshop safety and c. Material safety.

Group work/Collaborative Learning
• Place learners into mixed ability groups and task them to co-operatively discuss the causes of accident in the workshop with open-mindedness and patience.
• Guide learners in mixed gender ability groups to co-operatively discuss passionately reasons for observing safety precautions in the woodwork shop with open-mindedness and patience.
• Place learners into mixed ability groups and task them to co-operatively identify the safety measures to be observed under the personal safety, workshop safety and materials safety in the workshop with open-mindedness.

Digital Literacy learning: Task learners in mixed ability groups to co-operatively use goggle search engine (YouTube) surf for videos of protective clothing used in a workshop with open-mindedness.

Experiential learning: Task learners to apply the appropriate safety measures in the workshop with self-Control, cleanliness, sense of responsibility and work ethics.</td><td>Level 1 Recall
Level 2 Skills of conceptual understanding
Level 3 Strategic reasoning
Level 4 Extended critical thinking and reasoning</td></tr>
<tr><td>Teaching and Learning Materials</td><td>• Gloves
• Goggles
• Aprons</td><td>• Strong leather boots
• Face mask
• Helmet/cap/beret</td><td>• Ear protector/earmuff
• Computer/Smart phone</td></tr>
</table>

Subject APPLIED TECHNOLOGY
Strand 5. WOODWORK TECHNOLOGY
Sub-Strand 2. MATERIALS AND ARTEFACTS PRODUCTION WOODOWRK INDUSTRY IN GHANA

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
1.5.2.LO.1		
Demonstrate knowledge and understanding in the classification of timber and its processing phases in the woodwork industry.	**Critical thinking and Problem solving, Communication, Collaboration and Leadership skills:** The group activities develop critical thinking and problem solving, literacy, communication and collaboration **Digital literacy:** The surf for videos on the YouTube on advantages and disadvantages of the conversion methods develops digital literacy **Critical Thinking:** • The assessment level 3 facilitates Strategic Thinking/ Reasoning and assessment level 4 facilitate the development of Extended Critical Thinking • The identification and explanation of softwoods and hardwoods facilitate the development of Critical thinking and Experiential learning.	**GESI:** Having encountered gender equality and social inclusion-based teaching pedagogy, where each student is important and affected by the learning activities which reinforce knowledge and skill acquisition, it is expected that students and groups will: • Emphasize on attitudes and values that promote gender equality and social inclusion. • Balance representation of males and females and all marginalized groups in the content. • Appreciate mixed ability and socio-economic backgrounds. • Embrace differentiated teaching and assessment building on consideration of prior learning of learners. • Engaged equally regardless of their socio-economic background and religion. • Personalize and inculcate core values and skills in wood technology for personal and national development. **SEL:** Creating opportunities for learners to build their Social Emotional Learning Competencies - *Self-Awareness, Self-Management, Social Awareness, Relationship Skills and Responsible Decisions* are integrated

		throughout all lessons to encourage inclusion. The teacher should apply the social emotional learning strategies to ensure that learners are: • Establish and maintain healthy and rewarding relationships with diverse individuals and groups. • Showing empathy and cooperation • Interact based on consideration of ethical standards, safety concerns, social norms and the well-being of self and others. These may be done by the teacher through modelling emotional self-regulation and decision making, and the promotion of positive self-talk with self-made portraits, creation of a vision board, creating respectful icebreaker for healthy debates, encourage diversity presentations, and learners writing on the sequence of their activities. **National Value:** Self-Control, Open-mindedness, Passion, Responsibility, Co-operation, Work Ethics, Cleanliness, Patience, Tolerance.
1.5.2.LO.2		
Demonstrate knowledge and understanding of manufactured boards from Wood and non-wood residues to describe their types and uses	**Critical Thinking** • The brainstorming by the whole class session leads to critical thinking. • The assessment level 3 facilitates Strategic Thinking/ Reasoning and assessment level 4 facilitate the development of Extended Critical Thinking **Communication, Collaboration and Leadership skills:** The group activities develop critical thinking and problem solving, literacy, communication and collaboration	**GESI:** • The grouping based on mixed ability and socio-economic background • The Balanced representation of males and females and all marginalised groups in the content • The differentiated teaching and assessment building on consideration of prior learning of learners

	Digital Literacy: The surf for videos on the YouTube on the production processes and uses of manufactured boards develops digital literacy	• The Emphasis on attitudes and values that promote gender equality and social inclusion **SEL:** Learners have been taken through teaching strategies that ensure social inclusion, social justice and emotional control. The teacher should apply the social emotional learning strategies to ensure that learners are: • Avoiding bullying and cheating on the less privilege ones • Appreciating stress and trying to manage emotional challenges • Recognizing the problem of others and trying to empathise with them These may be done by the teacher through modelling emotional self-regulation and decision making, and the promotion of positive self-talk with self-made portraits, creation of a vision board, creating respectful icebreaker for healthy debates, encourage diversity presentations, and learners writing on the sequence of their activities. **National Values:** Co-operation, Open-mindedness, polite, orderly.

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
1.5.2.CS.1	1.5.2.LI.1	1.5.2.AS.1
Demonstrate knowledge and understanding of classification and processing phases of timber in the woodwork industry	**Classify the two main types of timber** **Experiential learning:** Display samples of different types of wood species and task learners in mixed ability groups to carefully identify and passionately explain softwoods and hardwoods with open-mindedness. **Group work/Collaborative Learning /Digital Literacy learning.** • Guide learners in mixed gender ability groups to co-operatively discuss the differences between hardwoods and softwoods with open-mindedness. • Task learners in mixed ability groups to passionately use the google search engine (YouTube) to surf for videos to assist them discuss the uses of hardwoods and softwoods with open-mindedness and Work Ethics. • Guide learners in mixed ability groups to explain the various processing phases of timber with open-mindedness and Work Ethics. **Critical Thinking and Talk for Learning Approaches:** Guide learners through class session to brainstorm the meaning and methods of conversion of timber with open-mindedness and Faithfulness. **Group work/Collaborative Learning:** Task learners in mixed ability groups to explain and discuss the seasoning methods in timber processing with open-mindedness and Faithfulness. **Group work/Collaborative Learning /Digital Literacy learning:** Guide learners in mixed ability groups to use the google search engine (YouTube) surf for videos to assist them discuss the advantages and disadvantages of the conversion methods with open-mindedness, Co-operation and Work Ethics.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	1.5.2.LI.2	2.5.2.AS.2
	Outline the processing phases of timber in the woodwork industry **Experiential learning:** Display samples of different types of wood species and task learners in mixed ability groups to carefully identify and passionately explain softwoods and hardwoods with open-mindedness.	**Level 1 Recall** **Level 2 Skills of conceptual understanding**

	Group work/Collaborative Learning /Digital Literacy learning. • Guide learners in mixed gender ability groups to co-operatively discuss the differences between hardwoods and softwoods with open-mindedness. • Task learners in mixed ability groups to passionately use the google search engine (YouTube) to surf for videos to assist them discuss the uses of hardwoods and softwoods with open-mindedness and Work Ethics. • Guide learners in mixed ability groups to explain the various processing phases of timber with open-mindedness and Work Ethics. **Critical Thinking and Talk for Learning Approaches:** Guide learners through class session to brainstorm the meaning and methods of conversion of timber with open-mindedness and Faithfulness. **Group work/Collaborative Learning:** Task learners in mixed ability groups to explain and discuss the seasoning methods in timber processing with open-mindedness and Faithfulness. **Group work/Collaborative Learning /Digital Literacy learning:** Guide learners in mixed ability groups to use the google search engine (YouTube) surf for videos to assist them discuss the advantages and disadvantages of the conversion methods with open-mindedness, Co-operation and Work Ethics.	**Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
Teaching and Learning Materials	• Hand specimens of softwoods and hardwoods/xylarium • YouTube videos on timber conversion/Flip chart • specimens of wood sawn using the conversion methods. • YouTube videos on timber seasoning/Flip chart	• specimens of seasoned timber • Computer/Smart phone • Magnifying hand lens/knife • Wood anatomy laboratory/Visit a xylarium/collection of timber species specimens

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
1.5.2.CS.2	1.5.2.LI.1	1.5.2.AS.1
Demonstrate knowledge and understanding of Utilisation of Manufactured Boards from Wood Residues.	**Explain the types of manufactured boards made from Wood and non-wood residues** **Critical Thinking and Talk for Learning Approaches:** Guide learners through whole class session to brainstorm the meaning of manufactured boards with open-mindedness **Group work/Collaborative Learning** • Task learners in mixed ability groups to politely discuss the types and characteristics of manufactured boards. • Task learners in mixed gender ability groups to surf for YouTube videos and watch the production processes of manufactured boards with open-mindedness. • Assist learners in mix ability groups to co-operatively discuss and tabulate the advantages and disadvantages of manufactured boards over solid wood in an orderly manner.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
	1.5.2.LI.2	1.5.2.AS.2
	Discuss the advantages of manufactured boards over solid wood. **Critical Thinking and Talk for Learning Approaches:** Guide learners through whole class session to brainstorm the meaning of manufactured boards (Engineered wood) with open-mindedness **Group work/Collaborative Learning** • Task learners in mixed ability groups to politely discuss the types and characteristics of manufactured boards. • Task learners in mixed gender ability groups to surf for YouTube videos and watch the production processes of manufactured boards with open-mindedness. • Assist learners in mix ability groups to co-operatively discuss and tabulate the advantages and disadvantages of manufactured boards over solid wood in an orderly manner.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
	1.5.2.LI.3	1.5.2.AS.3
	Outline the uses of manufactured boards made from Wood and non-wood residues **Critical Thinking and Talk for Learning Approaches:** Guide learners through whole class session to brainstorm the meaning of manufactured boards (Engineered wood) with open-mindedness **Group work/Collaborative Learning**	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning

	• Task learners in mixed ability groups to politely discuss the types and characteristics of manufactured boards. • Task learners in mixed gender ability groups to surf for YouTube videos and watch the production processes of manufactured boards with open-mindedness. • Assist learners in mix ability groups to co-operatively discuss and tabulate the advantages and disadvantages of manufactured boards over solid wood in an orderly manner.	Level 4 Extended critical thinking and reasoning
Teaching and Learning Materials	• Hand samples of manufactured boards • YouTube videos on manufactured boards/Flip chart • Computer/Smart phone	

YEAR TWO

Subject APPLIED TECHNOLOGY
Strand 1. AUTOMOTIVE TECHNOLOGY
Sub-Strand 1. INTRODUCTION TO ENGINE TECHNOLOGY

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
2.1.1.LO.1		
Perform engine cooling and lubrication system inspection, maintenance, diagnosis and repairs with limited supervision	**Communication and collaboration skills**: • By sharing ideas confidently and effectively to different participants in different groups • Through group discussion using appropriate language expressions orally and written • Through freedom of expression and good use of language to effectively share their views in the cooling and lubrication procedures. **Critical thinking and problem-solving skills** • Use of knowledge of resources to identify resources available to different socio-cultural background • Able to identify and analyse different points of view they hear in a discussion and explain how they are different. • By applying decision making process and skills to solve real-life problems.	**GESI:** Learners having experienced a teaching approach that ensures gender equality and social inclusion, where they work with each other in an inclusive way; cross-sharing knowledge and understanding among groups and individuals lead them to: • Embrace diversity and practice inclusion. • Examine and dispel misconceptions/ myths about gender as they relate to technical education • Interrogate their stereotypes and biases about gender and the role men and women play in technical education • Identify injustice, especially in recognition of the contributions of different groups and individuals to the effective servicing and maintenance of the engine systems. • Sensitive to the inter-relatedness of the various aspects of engine systems. • Value and promote health and safety in workshop and in society. **SEL:** All learning experiences related to engine technology should give learners the opportunities to develop the social

		emotional learning competencies, which include self-awareness, self-management, social awareness, relationship skills, and responsible decision-making. The teacher should implement the social emotional learning strategies to make sure that learners achieve each learning outcome in the engine technology and be • Reflecting about oneself and gaining confidence • Exhibiting motivation and SMART goal setting • Managing feelings, emotions and conflicts • Showing empathy and cooperation The following strategies may be adopted by the teacher in achieving SEL • modelling emotional self-control and judgment • promotion of positive self-talk with self-made portraits of engineering practices • making of a vision board, coming up with respectful conversation starters for healthy debates • Encourage learners to write about the order of their activities and diversity presentations. **National Values:** hard work, tolerance, respect for others, fairness and pursuit of excellence.

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
2.1.1.CS.1	2.1.1.LI.1	2.1.1.AS.1
Demonstrate understanding in the working principles of engine cooling and lubrication systems	**Explain** engine cooling system **and describe the construction and operation of the air-cooling systems** **Problem based Learning:** Learners brainstorm in groups with views tolerated from others, to discuss the exact purpose of cooling system, the two main types and also examine the layout of air-cooling systems on a motor vehicle and present a report for discussions. **Experiential learning:** Learners visit a local repair or school workshop to observe the working principle of air-cooled engines	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	2.1.1.LI.2	2.1.1.AS.2
	Describe the construction and operation of the thermosyphon and pump assisted water-cooling systems **Problem based Learning:** Learners brainstorm in groups with views tolerated from others, to discuss the exact purpose of cooling system, and also examine the layout of thermosyphon and pump assisted water-cooling systems on a motor vehicle and present a report for discussions. **Experiential learning:** Learners visit a local repair or school workshop to observe the working principle of thermosyphon and pump assisted water cooled engines	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	2.1.1.LI.3	2.1.1.AS.3
	Describe the construction and operation of the thermostat and pressurized water-cooling systems **Problem based Learning:** Learners brainstorm in groups with views tolerated from others, to discuss the construction and operation of thermostat and pressurised water-cooling systems on a motor vehicle and present a report for discussions. **Experiential learning:**	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**

	Learners visit a local repair or school workshop to observe the working principle of thermostat and pressurised water cooled engines	
	2.1.1.LI.4	2.1.1.AS.4
	Examine the parts of the lubrication systems and the components to be lubricated **Group work/collaborative learning:** In a fair mixed group learners use appropriate real objects, sketches or chart to identify the parts of lubrication system and the engine component to be lubricated and explain the purpose of the lubrication system. **Problem based Learning:** Learners work independently or in groups to identify the parts of lubrication system and the engine component to be lubricated	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	2.1.1.LI.5	2.1.1.AS.5
	Describe types of lubrication systems, oil pumps and oil filters **Group work/collaborative learning:** • In a fair mixed group learners use appropriate sketches or chart to describe types of lubrication systems (mist, wet and dry sump lubrication). • Assist learners in small groups to discuss the various oil pumps and filters. **Problem based Learning:** • Learners work independently or in groups to describe types of lubrication systems (mist, wet and dry sump lubrication) in relation to the various engines. • Assist learners to brainstorm and discuss the various oil pumps and filters used on vehicles.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	2.1.1.LI.6	2.1.1.AS.6
	Explain the properties and classifications of engine lubricating oil and crankcase ventilation. **Group work/collaborative learning:** In a fair mixed group learners use appropriate resources to identify the properties and classifications of engine lubricating oil	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**

	and explain the purpose of the crankcase ventilation and their types. **Problem based Learning:** Learners work independently or in groups to identify the type of lubricants used on vehicles and brainstorm the procedure to change the engine oil.		
Teaching and Learning Materials	• Chart or real object • Sketches	• Video/YouTube • Industrial visit	

Subject APPLIED TECHNOLOGY
Strand 1. AUTOMOTIVE TECHNOLOGY
Sub-Strand 2. INTRODUCTION TO VEHICLE TECHNOLOGY

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
2.1.2.LO.1		
Perform steering and suspension system inspection, maintenance, diagnosis and repairs with limited supervision	**Communication and collaboration skills:** • As learners work in groups they listen to peers and ask relevant questions based on what they heard. • Learning from and contributing to the learning of others. • Able to adapt their presentation to better engage the audience during its delivery. • Able to identify and analyse different points of view they hear in a discussion and explain how they are different. **Critical thinking and Problem-solving skills:** • Ability to use justifiable principles to choose between the systems that they have identified. • Apply knowledge to real-life workings of steering and suspension systems. • Able to identify and analyse different points of view they hear in a discussion and explain how they are different. • Apply their knowledge or make connections with what they learn in real-life situations.	**GESI:** Learners having experienced a teaching approach that ensures gender equality and social inclusion, where they work with each other in an inclusive way; cross-sharing knowledge and understanding among groups and individuals lead them to: • Respect individuals of different backgrounds. • Embrace diversity and practice inclusion. • Examine and dispel misconceptions/ myths about gender as they relate to technical education • Interrogate their stereotypes and biases about gender and the role men and women play in technical education • Identify injustice, especially in recognition of the contributions of different groups and individuals to the effective servicing and maintenance of vehicle systems. • Sensitive to the inter-relatedness of the various aspects of vehicle systems. • Value and promote health and safety in workshop and in society. **SEL:** All learning experiences related to vehicle technology should give learners the opportunities to develop the social emotional learning competencies, which include self-awareness, self-

		management, social awareness, relationship skills, and responsible decision-making. The teacher should implement the social emotional learning strategies to make sure that learners achieve each learning outcome in the engine technology and be • Reflecting about oneself and gaining confidence • Exhibiting motivation and SMART goal setting • Managing feelings, emotions and conflicts • Showing empathy and cooperation The following strategies may be adopted by the teacher in achieving SEL: • modelling emotional self-control and judgment • promotion of positive self-talk with self-made portraits of engineering practices • making of a vision board, coming up with respectful conversation starters for healthy debates • Encourage learners to write about the order of their activities and diversity presentations. **National values:** fairness, respect for others, pursuit of excellence, accountability, integrity, hard work, tolerance and hard work

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
2.1.2.CS.1	2.1.2.LI.1	2.1.2.AS.1
Demonstrate knowledge and understanding of vehicle steering and suspension systems	**Explain front axle and stub axle, types and their functions** **Group work/collaborative learning:** • In groups using relevant sketches or real objects, assist learners to identify front axle assembly and stub axle, used on vehicles. • Learners also brainstorm various types of front axle assembly, stub axle and their functions **Experiential learning**: Learners visit a local repair workshop and observe critically the types of front axle assembly and stub axle, used on vehicles.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	2.1.2.LI.2	2.1.2.AS.2
	Describe the main components of the steering system and explain steering geometry and the angles involved. **Group work/collaborative learning:** • In groups using relevant sketches or real objects assist learners to identify the main component parts of the steering system on a vehicle and discuss how the steering system operates. • Learners also brainstorm various steering geometry and the various angles involved in vehicle steering systems **Experiential learning**: Learners visit a local repair workshop and observe critically and come out with the various steering geometry, various angles involved and wheel alignment process	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	2.1.2.LI.3	2.1.2.AS.3
	Describe the layout of vehicle suspension systems **Project-based learning:** Group learners to discuss types of suspension systems and present group report in class. Also, guide learners to examine the suspension system of cars and trucks and note the appropriate differences.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning

	2.1.2.LI.4	2.1.2.AS.4
	Explain leaf, coil and air suspension systems **Problem-Based Learning:** • Using sketches, chart or real object learners brainstorm the problem associated with the various springs such as leaf, coil and air suspension systems, • Assist learners to identify the various shock absorbers • Guide learners to remove and test telescopic shock absorber for serviceability	Level 1 Recall Level 2 Skills of conceptual understanding Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**
	2.1.2.LI.5	2.1.2.AS.5
	Describe an independent suspension system and its working principles Guide learners using relevant sketches, charts or real object to discuss the differences in construction between the wishbone and Macpherson type of suspension as well as the working principles of both types and present report	Level 1 Recall Level 2 Skills of conceptual understanding Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**
	2.1.2.LI.6	2.1.2.LI.6
	Describe vehicle wheels and tyres. **Groupwork/collaborative learning** Guide learners using relevant sketches, charts or real object to discuss the different types of wheels and tyres. **Experiential learning**: Learners visit a local repair workshop or a retail shop and observe critically the various types of vehicle wheels and tyres, tyre servicing and repair and present their report.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
Teaching and Learning Materials	• Chart or real object • Sketches	• Video/YouTube • Industrial visit

Subject APPLIED TECHNOLOGY
Strand 2. METAL TECHNOLOGY
Sub-Strand 1. ENGINEERING MATERIALS, TOOLS, AND MACHINES

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
2.2.1.LO.1		
Develop and apply skills of heat treatment to a particular metal and perform operations using grinding, drilling, lathe and shaping machines	**Critical thinking and Problem-solving skills:** • Share learning, questions and evaluate each other's ideas respectively. • Apply knowledge to real life situations or simulation by examining evidence in order to solve problems. **Creativity and Innovation skills:** • Can creatively convey simple ideas or concepts of immediate interest to other persons in a team. • Can generate multiple ideas or concepts when they are given a stimulus or initial idea as starting point. **Communication and Collaboration skills:** • Able to adapt their presentation to better engage the audience during its delivery • Assuming shared responsibility, cooperating and giving feedback. • As learners work in groups, they will exhibit ability to identify and analyse different points of view they hear in a discussion and explain how they are different.	**GESI:** Learners having experienced a teaching approach that ensures gender equality and social inclusion, where they work with each other in an inclusive way; cross-sharing knowledge and understanding among groups and individuals lead them to: • Respect individuals of different backgrounds. • Embrace diversity and practice inclusion. • Examine and dispel misconceptions/ myths about gender as they relate to technical education • Interrogate their stereotypes and biases about gender and the role men and women play in technical education • Identify injustice, especially in recognition of the contributions of different groups and individuals to the effective engineering practices • Sensitive to the inter-relatedness of the various aspects of metal work technology. • Value and promote health and safety in workshop and in society. **SEL:** All learning experiences related to materials, tools and machines should give learners the opportunities to develop the social

		emotional learning competencies, which include self-awareness, self-management, social awareness, relationship skills, and responsible decision-making. The teacher should implement the social emotional learning strategies to make sure that learners achieve each learning outcome in the metal technology and be • Reflecting about oneself and gaining confidence • Exhibiting motivation and SMART goal setting • Managing feelings, emotions and conflicts • Showing empathy and cooperation The following strategies may be adopted by the teacher in achieving SEL • modelling emotional self-control and judgment • promotion of positive self-talk with self-made portraits of engineering practices • making of a vision board, coming up with respectful conversation starters for healthy debates • Encourage learners to write about the order of their activities and diversity presentations. **National Values:** Discipline, fairness, safety and welfare of the public, respect for others, patience, tolerance and respect for others and pursuit of excellence.

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
2.2.1.CS.1	2.2.1.LI.1	2.2.1.AS.1
Demonstrate understanding in the use of engineering tools, materials and machines	**Describe various heat treatment processes with engineering examples and explain equilibrium diagrams.** **Group work/collaborative learning:** Group learners to discuss and tolerate each other's views on heat treatment of plain carbon steels using video. And to describe the heat treatment processes. Assist learners to use the iron carbon equilibrium diagram to explain the behaviour of plain carbon steel when heated and cooled. **Problem-Based Learning:** Learners investigate the conventional technique for quenching a plain carbon steel when heated and report to the class	**Level 1 Recall** Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	2.2.1.LI.2	2.2.1.AS.2
	Describe twist drills and use drilling and grinding machines. **Group work/Collaborative learning** • In mixed ability groups, assist learners to describe the twist drill and perform operations using drilling and grinding machines **Experiential Learning:** • At the workshop, assist learners to describe the twist drill and identify the major parts of the drilling and grinding machines and brainstorm their functions. • Visit a local workshop with learners comporting themselves and help them to identify the twist drill, observe and demonstrate the use of the grinding and drilling machines.	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	2.2.1.LI.3	2.2.1.AS.3
	Demonstrate the use of lathe and shaping machines. **Group work/collaborative learning:** • In mixed ability groups, assist learners to identify the major parts of the lathe	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning**

	and the shaping machines and brainstorm their functions in the school workshop. **Experiential Learning** • Visit a local workshop with learners comporting themselves and help them to identify, observe and demonstrate the use of the lathe and the shaping machines.	Level 4 Extended critical thinking and reasoning
	2.2.1.LI.4	2.2.1.AS.4
	Demonstrate the use of the milling machine and cutting fluids. **Group work/collaborative learning:** • In mixed ability groups, assist learners to identify the major parts of the milling machine and cutting fluids in the school workshop. Brainstorm their functions. **Experiential Learning** • Visit a local workshop with learners comporting themselves and help them to identify and observe and demonstrate the use of the milling machine and cutting fluids.	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	2.2.1.LI.5	2.2.1.AS.5
	Explain the various machining processes and relate them to manufacturing industry **Talk for learning approaches:** With video or simulation, learners are exposed to the various machining processes and the processes are effectively explained to them. **Experiential Learning:** Learners embark on educational visit and observe the modern matching processes and present report in the class	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	2.2.1.LI.6	2.2.1.AS.6
	Apply the principles of sand casting to produce articles **Group work:** • Group students to describe accurately and honestly the processes used in sand casting.	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning**

	• Using samples of sandcasting tools and equipment assist students to identify and discuss the characteristics of sand casting. Put students in groups and assist them to design and make articles using sand casting process.			**Level 4 Extended critical thinking and reasoning**
Teaching and Learning Materials	• Heat treatment equipment • video clips/YouTube of heat treatment process • Grinding, drilling	• lathe and shaping machines • video/YouTube • Educational trips	• Chart • real object • video clips	• Industrial visit • Sand casting equipment

Subject APPLIED TECHNOLOGY
Strand 2. METAL TECHNOLOGY
Sub-Strand 2. WELDING TECHNOLOGY

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
2.2.2.LO.1		
Apply knowledge of key processes and tools in welding technology and fabrication to carry-out tasks on sheet metal projects	**Communication and Collaboration skills:** • As learners work in groups, they will exhibit ability to identify and analyse different points of view they hear in a discussion and explain how they are different. • Able to follow and take part in a group discussion and express opinions when called upon. • Understand other people's perspectives and prepare them to function better in real-life, social and work situation. **Critical thinking and problem-solving skills:** • Ability to seek additional information to build understanding will be applied in brainstorming activities. • Thinking rationally and clearly to solve problems. • Able to identify and analyse different points of view they hear in a discussion and explain how they are different	**GESI:** Learners having experienced a teaching approach that ensures gender equality and social inclusion, where they work with each other in an inclusive way; cross-sharing knowledge and understanding among groups and individuals lead them to: • Respect individuals of different backgrounds. • Embrace diversity and practice inclusion. • Examine and dispel misconceptions/ myths about gender as they relate to technical education • Interrogate their stereotypes and biases about gender and the role men and women play in technical education • Identify injustice, especially in recognition of the contributions of different groups and individuals to the effective welding practices • Sensitive to the inter-relatedness of the various aspects of welding and fabrication technology. • Value and promote health and safety in workshop and in society. **SEL:** All learning experiences related to welding technology should give learners the opportunities to develop the social emotional learning competencies, which include self-awareness, self-

		management, social awareness, relationship skills, and responsible decision-making. The teacher should implement the social emotional learning strategies to make sure that learners achieve each learning outcome in the welding technology and be • Reflecting about oneself and gaining confidence • Exhibiting motivation and SMART goal setting • Managing feelings, emotions and conflicts • Showing empathy and cooperation The following strategies may be adopted by the teacher in achieving SEL: • modelling emotional self-control and judgment • promotion of positive self-talk with self-made portraits of engineering practices • making of a vision board, coming up with respectful conversation starters for healthy debates • Encourage learners to write about the order of their activities and diversity presentations. **National Values:** Commitment, integrity, hard work, tolerance, accountability, discipline, fairness, safety of welfare of the public and respect for others

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
2.2.2.CS.1	2.2.2.LI.1	2.2.2.AS.1
Demonstrate knowledge and understanding of key processes, tools and equipment for welding	**Explain basic metal forming processes with engineering products**. **Group work/collaborative learning:** Group learners to describe precisely the processes involved in basic metal forming processes and identify items that are made by these processes. **Experiential learning:** Learners embark on an educational visit to a local workshop and observe the basic metal forming processes and present a report to the class,	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	2.2.2.LI.2	2.2.2.AS.2
	Demonstrate forging, rolling and extrusion operations in sheet metal. **Group work/collaborative learning:** Group learners to describe and demonstrate precisely the processes involved in forging, rolling and extrusion operations in sheet metal. **Experiential learning:** Learners embark on an educational visit to a local workshop and observe forging, rolling and extrusion processes and present a report to the class.	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	2.2.2.LI.3	2.2.2.AS.3
	Perform basic cutting and bending operations in sheet metal fabrication **Project-based Learning:** • Guide learners to perform accurate basic cutting and bending operations in sheet metal operations incorporating appropriate sheet metal specifications and selection using appropriate tools and equipment available. • Assist learners to mark out and cut sheet metal to shape using hand and machine tools as well as bending sheet metal to form articles using hand and machine tools.	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	2.2.2.AS.4	2.2.2.LI.4
	Perform drawing, die and presses operation in sheet metal fabrication	Level 1 Recall

	Project-based Learning: • Guide learners to perform accurate drawing operations in sheet metal incorporating appropriate sheet metal specifications and selection using appropriate tools and equipment available. • Assist learners to use the die and presses to cut and form sheet metal to the desired shape.		Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	2.2.2.LI.5		2.2.2.AS.5
	Generate and outline the sequence of operations involved in the making of artefacts. **Group work/collaborative learning:** Organise the learners into mixed ability and gender inclusive groups with respect to others, task them to research on the sequence of operations and identify a design problem from a given situation		Level 1 Recall Level 2 Skills of conceptual understanding Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**
	2.2.2.LI.6		2.2.2.AS.6
	Explain and use the various tools and equipment for soft and hard soldering **Experiential learning:** Learners embark on educational visit and observe with safety guidelines the soft and hard soldering processes and present report in the class		Level 1 Recall Level 2 Skills of conceptual understanding Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**
Teaching and Learning Materials	• metal forming tools • sketches /chart • video/YouTube	• industrial visit • Sheet metal tools	• real object • Soldering equipment

Subject APPLIED TECHNOLOGY
Strand 3. BUILDING CONSTRUCTION TECHNOLOGY
Sub-Strand 2. SUBSTRUCTURE AND SUPERSTRUCTURE

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
2.3.2.LO.1		
Categorize and describe foundations used under various soil conditions.	**Critical thinking skills:** • All Learners will apply their communication skills through oral or written presentations to describe setting out. • All Learners will rely on the knowledge of one another in describing foundation footings. **Skills for Creativity:** • All Learners will apply collaboration skills through oral or written means to discuss the processes involved in excavation. • All Learners will rely on the knowledge of one another to compile the various types and functions of foundations given the soil type. • All Learners will rely on the knowledge of one another to discuss the composition of a floor (including a basement floor) processes involved in casting the floors and their functions.	**GESI:** Teaching strategies that ensure social inclusion, social justice and gender equality have been experienced by the learners through working together, sharing ideas and expressing themselves in groups and individually. Through GESI learners are able to: • appreciate religious and, socio-economic differences. • Accept diversity of opinions • Regard the equal opportunities given to them • Identify injustice meted out to them and boldly speak against it when it comes to, for instance, dealing with bullies that may find their way into group discussions or on Field Trips who may attempt to deny them opportunities in participation. • Recognize individual differences and accept them as such • Get rid of biases against gender or learners approaching proficiency • Express their views and opinions freely without fear • Encourage the marginalized to express their views and opinions freely without hesitations nor fear. **SEL:** Creating opportunities for learners to build their Social Emotional Learning Competencies - *Self-*

		Awareness, Self-Management, Social Awareness, Relationship Skills and Responsible Decisions are integrated throughout all lessons to encourage inclusion. As part of achieving each learning outcome in the curriculum, the teacher should apply the SEL strategies by promoting self-regulation, decision making and positive self-talk act. to ensure that learners are: • Self-reflecting and finding confidence when given the opportunity to communicate or show collaborative skills as all learners in various groups contribute what they know about foundations. • Exhibiting motivation, and SMART goal setting • Managing emotions and conflicts when participations at group discussions turn argumentative and frustrating. • Showing empathy and cooperation to colleagues that may not have been to any construction site before to take the time to understand issues regarding Foundations. **National Values**: Tolerance, friendliness, open mindedness, patience, hard work, humility, precision, accuracy, fairness, accountability, integrity and respect for others
2.3.2.LO.1		
Be able to differentiate Load bearing from non-load bearing components and their functions in the Super structure.	**Skills in Creativity:** • All Learners will rely on the knowledge of one another to explain load bearing and non- load bearing members of the Superstructure. • All Learners will rely on the knowledge of one another to discuss the functions of load-bearing and non-load bearing members of the superstructure.	**GESI:** Having benefited from pedagogical approaches which enhanced tremendous gender equality and social inclusion, be it at individual levels or group levels Learners would be expected to: • Show respect to individuals of different backgrounds.

		• Acknowledge diversity and practice inclusion. • Overlook misconceptions/ myths about gender as they relate to one another within the Construction team **SEL:** Creating opportunities for learners to build their Social Emotional Learning Competencies - *Self-Awareness, Self-Management, Social Awareness, Relationship Skills and Responsible Decisions* are integrated throughout all lessons to encourage inclusion. As part of achieving each learning outcome in the curriculum, the teacher should apply the social emotional learning strategies to ensure that learners are: • Self-reflecting on one's understanding of issues and finding confidence to express one's opinions and contributions in academic debates that crop up. • Exhibiting motivation, and SMART goal setting in order to make progress in one's chosen field of endeavour. • Managing emotions and conflicts when engaged in debates or brainstorming sessions where perceptions may differ from one individual to the other. • Showing empathy and cooperation to colleagues that may not be in same comfortable situations as one is. Teachers will be able attain these by: • imbibing in learners the spirit of cooperation and collaboration;

		• Encouraging diversity presentations among learners; • Teaching learners how to manage conflict using peer mediation **National Values:** Cooperation, Commitment, Integrity, Honesty, Equality, Sincerity, Tolerance, Friendliness, Open mindedness, Hard work, Humility Precision, Objectivity

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
2.3.2.CS.1	2.3.2.LI.1	2.3.1.AS.1
Demonstrate Knowledge and understanding of sub-structure of buildings.	**Explain substructure of buildings.** **Communication:** Organise whole Class and ask learners to explain the meaning of substructure of a building. **Collaboration**: In mixed ability groups ask learners to outline the functions of the substructure of a building.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	2.3.2.LI.2	2.3.1.AS.2
	Explain what setting out is. **Communication:** Organise whole Class and ask learners to explain the meaning of setting out and discuss the reasons why setting out of a building has to be done. **Collaboration:** In mixed ability groups ask learners to discuss methods of setting out.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	2.3.2.LI.3	2.3.1.AS.3
	Discuss methods of excavating foundation trenches **Communication:** Organise whole Class and ask learners to explain **excavation of foundation trenches.** **Collaboration:** In mixed ability groups ask learners to discuss methods of excavating foundation trenches. **Collaboration:** In mixed-ability groups ask Learners to discuss tools, plants and Equipment used in excavating foundation trenches.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	2.3.2.LI.4	2.3.1.AS.5
	Discuss the various types of foundation used given the soil condition. **Communication:** Organise whole Class and ask learners to explain foundation of buildings.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning**

	Collaboration: In mixed ability groups ask learners to discuss types of foundation. **Collaboration:** In mixed ability groups ask learners to discuss factors affecting the choice of foundation.	Level 4 Extended critical thinking and reasoning
	2.3.2.LI.5	2.3.1.AS.4
	Explain foundation Footing. **Communication:** Organize a whole class and ask learners to explain the meaning of footing course in the substructure. **Communication:** Organize a whole class and ask learners to outline the different materials used in laying footing course in the substructure. **Collaboration:** In mixed-ability groups ask Learners to discuss the Functions of footing course in the substructure of the building.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	2.3.2.LI.6	2.3.1.AS.6
	Discuss formwork. **Communication:** Organise whole Class and ask learners to explain what formworks are .and the materials used to prepare them. **Collaboration:** Organise whole Class and ask learners to discuss materials used in preparing formworks. **Collaboration:** In mixed-ability groups ask Learners to discuss the functions of formworks.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	2.3.2.LI.7	2.3.1.AS.7
	Discuss floor Construction. **Communication:** Organize whole Class and ask learners to explain the meaning of a floor (including basement floors.) **Collaboration:** In mixed-ability groups ask Learners to discuss the composition of a floor (including basement floor). These methods are to facilitate effective participation	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning

	and learning by different Learners (GESI) including Approaching Proficiency, the Proficient and the Highly Proficient. **Collaboration:** In mixed-ability groups ask Learners to discuss the functions of a floor (including basement floor). **Experiential Learning:** Embark on field trips to Construction sites for Learners to observe or learn about processes involved in substructure works.	
Teaching and Learning Materials	• Use of Simulation; Virtual to illustrate setting out. • Use of Flip Chat to illustrate excavations. • Use of Simulation, Virtual and Typical foundational works as seen in progress at different Construction sites to discuss various types of foundations given the soil type.	

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
2.3.2.CS.2	2.3.2.LI..1	2.3.2.AS.1
Demonstrate knowledge and understanding of Load bearing and non-Load bearing components of the superstructure.	**Explain load bearing and non-load bearing members of the superstructure** **Communication: Explain load-bearing and non-load bearing.** **Collaboration:** In structured groups (GESI) ask learners to outline load-bearing and non-load bearing members in the superstructure.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	2.3.2.LI.2	2.3.2.AS.2
	Discuss wall construction. **Collaboration:** In structured groups (GESI) ask learners to explain walls as used in the superstructure. In structured groups (GESI) ask learners to outline types of walls. In structured groups (GESI) ask learners to discuss functions of walls.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	2.3.2.LI.3	2.3.2.AS.3
	Discuss Doors, windows and their Frames. **Collaboration:** • In structured groups (GESI) ask learners to explain doors, windows and frames. • In structured groups (GESI) ask learners to outline types of doors and windows. • In structured groups (GESI) ask learners to discuss functions of doors and windows. • In structured groups (GESI) ask learners to outline materials used in the production of doors and windows.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	2.3.2.LI.4	2.3.2.AS.4
	Discuss roofs. **Communication:** In a whole class ask learners to explain roofs as building components of the Superstructure. **Collaboration:** • In mixed-ability groups ask learners to outline types of roof. • This method is to enhance effective participation in teaching and learning by different learners including the Approaching Proficiency, Proficiency and Highly Proficient.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning

	• (Identification of ability of learners and positioning to ensure mixed ability). • In structured groups (GESI) ask learners to discuss the functions of the roof as a component of the Superstructure. • In mixed-ability groups ask learners to outline materials used in roofing.	
	2.3.2.LI.5	2.3.2.AS.5
	Discuss Ceilings **Communication:** In a whole class ask learners to explain ceilings as building components of the Superstructure. **Collaboration:** • In mixed-ability groups ask learners to outline materials used for putting in place ceilings. This method is to enhance effective participation in teaching and learning by different learners including the Approaching Proficiency, Proficiency and Highly Proficient. • (Identification of ability of learners and positioning to ensure mixed ability). • In structured groups (GESI) ask learners to discuss the functions of a ceiling as a component of the Superstructure.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
Teaching and Learning Materials	• The use of Simulation; (virtual) to illustrate types of load-bearing and non-load bearing members of the superstructure. • The use of Superstructure works as observed at different Construction sites to illustrate the use of load and non-load bearing members. • The use of flip-charts to illustrate types and functions of load-bearing and non- load bearing members of the Superstructure.	

Subject APPLIED TECHNOLOGY
Strand 4. WOOD TECHNOLOGY
Sub-Strand 1. TOOLS AND MACHINES IN WOODWORK INDUSTRY

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
1.4.1.LO.1		
Demonstrate knowledge and understanding of hand tools and machines to select the right tool and machine for a specific woodwork operation	**Critical thinking and Problem solving, Communication, Collaboration and Leadership skills:** The group activities develop critical thinking and problem solving, literacy, communication and collaboration **Digital literacy:** The surf for videos on the YouTube on advantages and disadvantages of the conversion methods develops digital literacy **Critical Thinking:** • The assessment level 3 facilitates Strategic Thinking/ Reasoning and assessment level 4 facilitate the development of Extended Critical Thinking • The identification and explanation of softwoods and hardwoods facilitate the development of Critical thinking and Experiential learning.	**GESI:** Having encountered gender equality and social inclusion-based teaching pedagogy, where each student is important and affected by the learning activities which reinforce knowledge and skill acquisition, it is expected that students and groups will: • Emphasize on attitudes and values that promote gender equality and social inclusion. • Balance representation of males and females and all marginalized groups in the content. • Appreciate mixed ability and socio-economic backgrounds. • Embrace differentiated teaching and assessment building on consideration of prior learning of learners. • Engaged equally regardless of their socio-economic background and religion. • Personalize and inculcate core values and skills in wood technology for personal and national development. **SEL:** Creating opportunities for learners to build their Social Emotional Learning Competencies - *Self-Awareness, Self-Management, Social Awareness, Relationship Skills and Responsible Decisions* are integrated in wood technology to encourage inclusion. The teacher should apply

		the social emotional learning strategies to ensure that learners are: • Build their confidence in doing things or answering questions in class • Accept themselves as they are and try to control their attitude and behavior • Reflecting about oneself and gaining confidence These may be done by the teacher through modelling emotional self-regulation and decision making, and the promotion of positive self-talk with self-made portraits, creation of a vision board, creating respectful icebreaker for healthy debates, encourage diversity presentations, and learners writing on the sequence of their activities. **National Value:** Self-Control, Open-mindedness, Passion, Responsibility, Co-operation, Work Ethics, Cleanliness, Patience, Tolerance.

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
2.4.1.CS.1	2.4.1.LI.1	2.4.1.AS.1
Demonstrate the ability to use woodwork hand tools, Joints and Machines in the woodwork shops	**Select and use appropriate hand tool for a specific woodwork operation** **Critical Thinking and Talk for Learning Approaches:** Guide learners to brainstorm the meaning of the following with open-mindedness: 1. Geometrical tools (measuring tools, marking tools and setting out tools) 2. Abrading cutting tools 3. Paring and shaving cutting tools 4. Boring cutting tools 5. Impelling and precaution tools (driving tools) 6. Holding and supporting tools **Group work/Collaborative Learning:** • Organise learners into mixed ability groups and assist them to co-operatively identify and passionately classify tools under the following; 1. Geometrical tools (measuring tools, marking tools and setting out tools): E.g., Rule, Tape Measure, Callipers Pencil, Try Square, Marking Gauge, Mortise Gauge Cutting Gauge, Sliding Bevel 2. Abrading cutting tools: E.g. Hand saws 3. Paring and Shaping tools: E.g. Planes, Spoke shave, chisels, files, scrapper 4. Boring cutting tools: E.g. Ratchet brace, Wheel brace, woodwork bits, 5. Impelling and precaution tools (driving tools): E.g. Hammer, Screwdriver, Pincers, Nail punch, Mallet 6. Holding and supporting tools: E.g. Vice, Cramps • Assist learners in mixed ability groups to co-operatively discuss the uses of the following hand tools: 1. Geometrical tools (measuring tools, marking tools and setting out tools) 2. Abrading cutting tools 3. Paring and shaving cutting tools 4. Boring cutting tools 5. Impelling and precaution tools (driving tools) 6. Holding and supporting tools	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning

	Experiential learning/ Group work/Collaborative Learning • Guide learners in mixed ability groups to co-operatively select appropriate hand tool and use it properly taking into consideration self-Control and work ethics. • Task learners in mixed ability groups to co-operatively discuss the care and maintenance of hand tools, taking into consideration work ethics.	
	2.4.1.LI.2	2.4.1.AS.2
	Explain how to care for and maintain hand tools **Critical Thinking and Talk for Learning Approaches:** Guide learners to brainstorm the meaning of the following with open-mindedness: 1. Geometrical tools (measuring tools, marking tools and setting out tools) 2. Abrading cutting tools 3. Paring and shaving cutting tools 4. Boring cutting tools 5. Impelling and precaution tools (driving tools) 6. Holding and supporting tools **Group work/Collaborative Learning:** • Organise learners into mixed ability groups and assist them to co-operatively identify and passionately classify tools under the following; 1. Geometrical tools (measuring tools, marking tools and setting out tools): E.g., Rule, Tape Measure, Callipers Pencil, Try Square, Marking Gauge, Mortise Gauge Cutting Gauge, Sliding Bevel 2. Abrading cutting tools: E.g. Hand saws 3. Paring and Shaping tools: E.g. Planes, Spoke shave, chisels, files, scrapper 4. Boring cutting tools: E.g. Ratchet brace, Wheel brace, woodwork bits, 5. Impelling and precaution tools (driving tools): E.g. Hammer, Screwdriver, Pincers, Nail punch, Mallet 6. Holding and supporting tools: E.g. Vice, Cramps • Assist learners in mixed ability groups to co-operatively discuss the uses of the following hand tools: 1. Geometrical tools (measuring tools, marking tools and setting out tools) 2. Abrading cutting tools	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning

	3. Paring and shaving cutting tools 4. Boring cutting tools 5. Impelling and precaution tools (driving tools) 6. Holding and supporting tools **Experiential learning/ Group work/Collaborative Learning** • Guide learners in mixed ability groups to co-operatively select appropriate hand tool and use it properly taking into consideration self-Control and work ethics. • Task learners in mixed ability groups to co-operatively discuss the care and maintenance of hand tools, taking into consideration work ethics.	
	2.4.1.LI.3	2.4.1.AS.3
	Select and use appropriate machine for a specific woodwork operation **Group work/Collaborative Learning** • Guide learners in mixed ability groups to co-operatively and passionately identify the following machines: 1. Crosscut saw 2. Circular saw 3. Band saw 4. Dimension saw 5. Surface planner 6. Thicknesser/Combined surface planer and thicknesser • Assist learners in mixed ability groups to identify and describe the parts of the following machines co-operatively and passionately with open mindedness: 1. Crosscut saw 2. Circular saw 3. Band saw 4. Dimension saw 5. Surface planner 6. Thicknesser/Combined surface planer and thicknesser • Group work/Collaborative Learning /Critical Thinking and Talk for Learning Approaches in identifying modern (CNC) woodworking machine and their uses. • Assist learners in mixed ability groups to co-operatively discuss the uses of the following woodwork machines taking into consideration work ethics:	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning

	1. Crosscut saw 2. Circular saw 3. Band saw 4. Dimension saw 5. Surface planner. 6. Thicknesser//Combined surface planer and thicknesser **Digital Literacy learning:** Task learners to passionately use search engines (YouTube) to surf for videos on the uses of the following sawing machines with open-mindedness: 1. Crosscut saw 2. Circular saw 3. Band saw 4. Dimension saw. 5. Thicknesser/ Combined Surface planer and thicknesser **Experiential learning/ Group work/Collaborative Learning** • Guide learners with open-mindedness to select an appropriate machine and use it properly with self-control, taking into consideration work ethics. • Task learners in mixed ability groups to co-operatively discuss the care and maintenance of woodwork machines with passion.	
	2.4.1.LI.4	2.4.1.AS.4
	Explain how to care for and maintain hand tools and machines. **Group work/Collaborative Learning** • Guide learners in mixed ability groups to co-operatively and passionately identify the following machines: i. Circular saw ii. Crosscut saw. iii Band saw. iv. Dimension saw. v. Surface planner 1. Assist learners in mixed ability groups to identify and describe the parts of the following machines co-operatively and passionately with open mindedness: i. Circular saw ii. Crosscut saw. iii. Band saw iv. Dimension saw v. Surface planner vi. Thicknesser/Combined Surface planer and thicknesser. **Group work/Collaborative Learning /Critical Thinking and Talk for Learning Approaches:** Assist learners in mixed ability groups to co-operatively discuss the uses of the following woodwork machines taking into consideration work ethics:	Level 1 Recall Level 2 Skills of conceptual understanding Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**

	2. Crosscut saw 3. Circular saw. 4. Band saw 5. Dimension saw 6. Surface planner. 7. Thicknesser/Combined Surface planer and thicknesser **Digital Literacy learning:** Task learners to passionately use search engines (YouTube) to surf for videos on the uses of the following sawing machines with open-mindedness: i. Circular saw ii. Crosscut saw. iii. Band saw iv. Dimension saw. **Experiential learning/ Group work/Collaborative Learning** • Guide learners with open-mindedness to select an appropriate machine and use it properly with self-control, taking into consideration work ethics. • Task learners in mixed ability groups to co-operatively discuss the care and maintenance of woodwork machines with passion.		
Teaching and Learning Materials	• Measuring tools: E.g., Rule, Tape Measure, Callipers • Marking tools and setting out tools: Pencil, Try Square, Marking Gauge, Mortise Gauge Cutting Gauge, Sliding Bevel • Cutting and Shaping tools: Saws, Planes, Spoke shave • Circular saw • Band saw • Dimension saw • Surface planner • Thicknesser/Combined Surface planer and thicknesser	• Videos on the uses of the following Computer Numerical Control (CNC) machines: i. Circular saw ii. Crosscut saw iii. Band saw iv. Dimension saw v. Surface planner vi. Thicknesser/Combined Surface planer and thicknesser	• Rag • Duster • Screwdriver • Handyman tools. • Oil Crosscut saw.

Subject APPLIED TECHNOLOGY
Strand 4. WOOD TECHNOLOGY
Sub-Strand 2. MATERIALS AND ARTEFACT PRODUCTION IN WOODWORK IINDUSTRY IN GHANA

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
1.4.2.LO.1		
Apply knowledge and understanding in design and making of artefacts, translate the ideas into drawings using CAD and produce working drawings from the final solution and generate a model	**Critical thinking and Problem solving, Communication, Collaboration and Leadership skills:** The group activities develop critical thinking and problem solving, literacy, communication and collaboration **Digital literacy:** The surf for videos on the YouTube on advantages and disadvantages of the conversion methods develops digital literacy **Critical Thinking:** • The assessment level 3 facilitates Strategic Thinking/ Reasoning and assessment level 4 facilitate the development of Extended Critical Thinking • The identification and explanation of softwoods and hardwoods facilitate the development of Critical thinking and Experiential learning.	**GESI:** Having encountered gender equality and social inclusion-based teaching pedagogy, where each student is important and affected by the learning activities which reinforce knowledge and skill acquisition, it is expected that students and groups will: • Emphasize on attitudes and values that promote gender equality and social inclusion. • Balance representation of males and females and all marginalized groups in the content. • Appreciate mixed ability and socio-economic backgrounds. • Embrace differentiated teaching and assessment building on consideration of prior learning of learners. • Engaged equally regardless of their socio-economic background and religion. • Personalize and inculcate core values and skills in wood technology for personal and national development. **SEL:** Creating opportunities for learners to build their Social Emotional Learning Competencies - *Self-Awareness, Self-Management, Social Awareness, Relationship Skills and Responsible Decisions* are integrated in wood technology to encourage inclusion. The teacher should apply the social

		emotional learning strategies to ensure that learners are: • Resist inappropriate social pressure, negotiating conflict constructively, and seek to offer help when needed. • Develop sense of respect for others These may be done by the teacher through modelling emotional self-regulation and decision making, and the promotion of positive self-talk with self-made portraits, creation of a vision board, creating respectful icebreaker for healthy debates, encourage diversity presentations, and learners writing on the sequence of their activities. **National Value:** Self-Control, Open-mindedness, Passion, Responsibility, Co-operation, Work Ethics, Cleanliness, Patience, Tolerance.
1.4.2.LO.2		
Demonstrate knowledge and understanding of finishes and finishing to select and apply the appropriate finishes to an artefact.	**Critical Thinking** • The brainstorming by the whole class session leads to critical thinking. • The assessment level 3 facilitates Strategic Thinking/ Reasoning and assessment level 4 facilitate the development of Extended Critical Thinking **Communication, Collaboration and Leadership skills:** The group activities develop critical thinking and problem solving, literacy, communication and collaboration **Digital Literacy:** The surf for videos on the YouTube on the production processes and uses of manufactured boards develops digital literacy	**GESI:** Having encountered gender equality and social inclusion-based teaching pedagogy, where each student is important and affected by the learning activities which reinforce knowledge and skill acquisition, it is expected that students and groups will: • Emphasize on attitudes and values that promote gender equality and social inclusion. • Balance representation of males and females and all marginalized groups in the content. • Appreciate mixed ability and socio-economic backgrounds.

		• Embrace differentiated teaching and assessment building on consideration of prior learning of learners. • Engaged equally regardless of their socio-economic background and religion. • Personalize and inculcate core values and skills in wood technology for personal and national development. **SEL:** Creating opportunities for learners to build their Social Emotional Learning Competencies - *Self-Awareness, Self-Management, Social Awareness, Relationship Skills and Responsible Decisions* are integrated in wood technology to encourage inclusion. The teacher should apply the social emotional learning strategies to ensure that learners are: • Develop sense of confidence and optimism in communication • Develop sense of respect for others • Recognize the problem of others and try to empathise with them. These may be done by the teacher through modelling emotional self-regulation and decision making, and the promotion of positive self-talk with self-made portraits, creation of a vision board, creating respectful icebreaker for healthy debates, encourage diversity presentations, and learners writing on the sequence of their activities. **National Value:** Self-Control, Open-mindedness, Passion, Responsibility, Co-operation, Work Ethics, Cleanliness, Patience, Tolerance.

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
2.4.2.CS.1	2.4.2.LI.1	2.4.2.AS.1
Apply knowledge of design and making in artefacts production.	**Apply Computer Aided Design [CAD] in designing and making of artefacts** **Experiential learning/ Project-based Learning/ Group work/Collaborative Learning** • Task learners in mixed ability groups to passionately sketch possible solutions to a given situation and Brief with open-minded • Assist learners in mixed ability groups to co-operatively generate possible solutions for the Situation and Brief with open-mindedness. **Digital Literacy learning/ Group work/Collaborative Learning** • Place learners in mixed ability groups and task them to passionately use (CAD) to draw possible solutions with open-mindedness. • Guide learners in mixed ability groups to passionately use CAD in the development of chosen ideas with open-mindedness. • Task learners to passionately use (CAD) to produce the final solution with open-mindedness. • Assist learners in mixed-gender groups to co-operatively use CAD to prepare working drawings of their final solution in either first or third-angle orthographic projections with open-mindedness. **Experiential learning/ Project-based Learning/ Group work/Collaborative Learning** • Task learners to passionately and with open-mindedness, select and discuss appropriate materials suitable for producing the final solution taking into consideration work ethics. • Engage learners to passionately produce models from their drawings to conform to working drawings with open-mindedness.	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	2.4.2.LI.2	2.4.2.AS.2
	Produce working drawings from the final solution	Level 1 Recall

	Experiential learning/Project-based Learning/ Group work/Collaborative Learning • Task learners in mixed ability groups to passionately sketch possible solutions to a given Situation and Brief with open-minded • Assist learners in mixed ability groups to co-operatively generate possible solutions for the Situation and Brief with open-minded. **Digital Literacy learning/ Group work/Collaborative Learning** • Place learners in mixed ability groups and task them to passionately use (CAD) to draw possible solutions with open-mindedness. • Guide learners in mixed ability groups to passionately use CAD in development of chosen idea with open-minded. • Task learners to passionately use (CAD) to produce final solution with open-minded. • Assist learners in mixed gender group to co-operatively use CAD to prepare working drawings of their final solution in either first or third angle orthographic projections with open-mindedness. **Experiential learning/ Project-based Learning/ Group work/Collaborative Learning** • Task learners to passionately and with open-mindedness, select and discuss appropriate materials suitable for producing the final solution taking into consideration work ethics. • Engage learners to passionately produce model from their drawing to conform to working drawing with open-mindedness.	Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	2.4.2.LI.3	2.4.2.AS.3
	Select appropriate materials suitable for producing the final solution **Experiential learning/ Project-based Learning/ Group work/Collaborative Learning** • Task learners in mixed ability groups to passionately sketch possible solutions to a given Situation and Brief with open-minded	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**

	• Assist learners in mixed ability groups to co-operatively generate possible solutions for the Situation and Brief with open-minded. **Digital Literacy learning/ Group work/Collaborative Learning** • Place learners in mixed ability groups and task them to passionately use (CAD) to draw possible solutions with open-mindedness. • Guide learners in mixed ability groups to passionately use CAD in development of chosen idea with open-minded. • Task learners to passionately use (CAD) to produce final solution with open-minded. • Assist learners in mixed gender group to co-operatively use CAD to prepare working drawings of their final solution in either first or third angle orthographic projections with open-mindedness. **Experiential learning/ Project-based Learning/ Group work/Collaborative Learning** • Task learners to passionately and with open-mindedness, select and discuss appropriate materials suitable for producing the final solution taking into consideration work ethics. • Engage learners to passionately produce model from their drawing to conform to working drawing with open-mindedness.	
	2.4.2.LI.4	2.4.2.AS.4
	Produce a model from your working drawings **Experiential learning/ Project-based Learning/ Group work/Collaborative Learning** • Task learners in mixed ability groups to passionately sketch possible solutions to a given Situation and Brief with open-minded • Assist learners in mixed ability groups to co-operatively generate possible solutions for the Situation and Brief with open-minded. **Digital Literacy learning/ Group work/Collaborative Learning** • Place learners in mixed ability groups and task them to passionately use (CAD) to draw possible solutions with open-mindedness.	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**

	• Guide learners in mixed ability groups to passionately use CAD in development of chosen idea with open-minded. • Task learners to passionately use (CAD) to produce final solution with open-minded. • Assist learners in mixed gender group to co-operatively use CAD to prepare working drawings of their final solution in either first or third angle orthographic projections with open-mindedness. **Experiential learning/ Project-based Learning/ Group work/Collaborative Learning** • Task learners to passionately and with open-mindedness, select and discuss appropriate materials suitable for producing the final solution taking into consideration work ethics. • Engage learners to passionately produce model from their drawing to conform to working drawing with open-mindedness.		
Teaching and Learning Materials	• Wood • Nails	• Glue • Plywood	• bench • hand tools

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
2.4.2.CS.2	2.4.2.LI.1	2.4.2.AS.1
Apply knowledge of Finishing to Artefacts	**Select and use appropriate joints for a specific woodwork operation** **Critical Thinking and Talk for Learning Approaches:** Guide learners to brainstorm the meaning of the following with open-mindedness: a) Angle joint/Framing joint. b) Widening joint. **Group work/Collaborative Learning:** • Organise learners into mixed ability groups and assist them to co-operatively identify and passionately classify joints under the following; 1. Angle joints/Framing joints: E.g., Dovetail, Housing, Dowel, Rebate, Box-pin, Barefaced tongue and groove, Mortise and Tenon, Bridle, Mitre, Dowel, Halving. 2. Widening joints: Tongue and groove, Dowel • Assist learners in mixed ability groups to co-operatively discuss the uses of the following joints: 1. Angle joint/Framing joint. 2. Widening joint. **Experiential learning/ Group work/Collaborative Learning** Guide learners in mixed ability groups to co-operatively select appropriate joints and use it properly taking into consideration self-Control and work ethics.	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	2.4.2.LI.2	2.4.2.AS.2
	Explain the uses of different types of adhesives **Critical Thinking and Talk for Learning Approaches:** Learners think pair share to passionately identify different types of adhesives. **Group work/Collaborative Learning**	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**

	• Guide learners in mixed gender groups to discuss the uses of the following adhesives co-operatively and passionately: 1. Protain adhesive 2. Synthetic resin adhesive **Experiential learning/ Group work/Collaborative Learning** • Task learners in mixed ability groups to select an appropriate adhesive for artefact co-operatively and passionately • Engage learners in mixed gender ability groups to apply the right type of adhesive to artefacts/models taking into consideration work ethics. • Task learners with open-mindedness to apply safety measures when adhesive, taking into consideration work ethics.	
	2.4.2.LI.3	2.4.2.AS.3
	Explain the uses and application of different types of finishes **Critical Thinking and Talk for Learning Approaches:** Learners think pair share to passionately identify and describe the tools and materials for preparation of surfaces of artefacts (cleaning-up). **Group work/Collaborative Learning** • Organise learners into mixed ability to co-operatively and passionately identify the different types of finishes for an artefact with open-mindedness. • Guide learners in mixed gender groups to discuss the uses of the following finishes co-operatively and passionately: 1. Lacquers 2. Vanishes 3. Paints 4. Laminated Plastics 5. Polishes **Experiential learning/ Group work/Collaborative Learning** • Assist learners to courageously and passionately demonstrate processes such as: planning, scraping, glass papering, filling, staining, bleaching,	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**

	spraying and polishing taking into consideration work ethics and self-control. • Task learners in mixed ability groups to select an appropriate finish for artefact co-operatively and passionately • Engage learners in mixed gender ability groups to apply the right type of finishes to artefacts/models taking into consideration work ethics. • Task learners with open-mindedness to apply safety measures when finishing, taking into consideration work ethics.	
	2.4.2.LI.4	2.4.2.AS.4
	Apply an appropriate finish to an artefact **Critical Thinking and Talk for Learning Approaches:** Learners think pair share to passionately identify and describe the tools and materials for preparation of surfaces of artefacts (cleaning-up). **Group work/Collaborative Learning:** • Organise learners into mixed ability to co-operatively and passionately identify the different types of finishes for an artefact with open-mindedness. • Guide learners in mixed gender groups to discuss the uses of the following finishes co-operatively and passionately: 1. Lacquers 2. Vanishes 3. Paints 4. Laminated Plastics 5. Polishes E**xperiential learning/ Group work/Collaborative Learnin**g: • Assist learners to courageously and passionately demonstrate processes such as: planning, scraping, glass papering, filing, staining, bleaching, spraying and polishing taking into consideration work ethics and self-control. • Task learners in mixed ability groups to select an appropriate finish for artefact co-operatively and passionately	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**

	• Engage learners in mixed gender ability groups to apply the right type of finishes to artefacts/models taking into consideration work ethics. • Task learners with open-mindedness to apply safety measures when finishing, taking into consideration work ethics.			
Teaching and Learning Materials	• Lacquers • Vanishes	• Paints • Laminated Plastics	• Polishes • Brush	• Spraying gun

Subject APPLIED TECHNOLOGY
Strand 5. ELECTRICAL AND ELECTRONIC TECHNOLOGY
Sub-Strand 1. ELECTRICAL SYSTEMS DESIGN

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
2.5.1.LO.1		
Apply appropriate tools and wiring systems to carry out key wiring processes.	**Collaboration and Communication** • Learners express their ideas during pair and group work, share ideas and respect one another in group and pair work as well as present both oral and written reports. • Oral and written group idea sharing Respecting and accepting group members' contributions • Sharing ideas and working together in pair and group activities. **Critical Thinking and Problem-Solving skills.** Being able to analyse, judge, and draw conclusions about the differences and similarities of the various methods in house wiring • Capability to imagine and plan a particular type of wiring required for a specific job. • Ability to assess a particular type of wiring in terms of its advantages and disadvantages and use it appropriately. • Capability to think critically and solve problems associated with house wiring. **Digital literacy skills:** • Can confidently prepare presentations using ICT and respecting other people's privacy. • Sharing information among team members using social media ethically. • Ability to search and share digital information. • Ability to type presentations and reports.	**GESI:** There is always a diverse group of learners in the classroom, each with unique needs and challenges. Therefore, it is essential to make sure that all teaching and learning approaches promote gender equality and social inclusion. learners learning electricals who have been introduced these techniques are more likely to: • Appreciate the choice of wiring system each person makes. • Appreciate the views of others when discussing electrical issues. • Value the views and contributions of others when taking decisions. **SEL:** Learners have been introduced to the educational strategies used to achieve social inclusion, social justice, and emotional regulation. Through SEL, learners are able to: • make a choice between the various types of wiring systems and available materials depending on the situation at hand. • be aware of his/her strength and weaknesses as far as the learning of electrical wiring is concern so as to seek for help where necessary.

	• Being able to research wiring methods, tools and materials using ICT tools such as the Google search engine and U-tube. **Leadership Skills and Personal Development** • Capable of expressing and explaining one's feelings in a group setting while working with others. • Taking on leadership roles in group projects • Demonstrate the ability to contribute to team discussions in order to reach an agreement on what action should be taken. • Exhibit the ability to assign tasks to different team members and recognize when their peers may require support or assistance. **Innovation and Creativity** • Performing tasks in novel ways that broaden learners' learning and decision-making on types of wiring circuits.	• relate to other learners when group assignment is given. • manage his /her time very well when given individual assignment. **National Core values:** For a country to advance, its people must build a set of values that will propel the country's development. Particularly with competent individuals, values like patriotism, honesty, accountability, and hard work are necessary to assure advancement and growth in industries. Therefore, learners are anticipated to: • exhibit sense of responsibility in the care and maintenance of tools and equipment in the electrical workshop. • be honest and sincere with clients when estimating and purchasing materials for their household wiring. • exhibit some sense of responsibility when working with tools in the workshop (in terms of theft)

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
2.5.1.CS.1	2.5.1.LI.1	2.5.1.AS.1
Demonstrate understanding of House Wiring	**Explain house wiring and provide reasons for doing good wiring.** **Initiating Talk for Learning and Talk for Learning:** Through a whole class discussion and by surfing through the internet engage learners to go through the following activities • Explain the term 'house wiring.' • Outline the importance of house wiring • Provide reasons for doing good wiring. **Collaborative Learning:** Engage learners in mixed ability groupings to: Outline the consequences of doing improper wiring **NB.** Ensure all learners participate in all varieties of practical activities and project work given mixed gender groupings as well.	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	2.5.1.LI.2	2.5.1.AS.2
	Describe tools and equipment used for house wiring **Research and Collaboration:** • Organise the learners into mixed ability and gender inclusive groups, task them to research on the tools used for house wiring and what each is used for. E.g.; pliers, side cutter, laser light, multi-meter, draw wir, among others. • Functions of each tool • Care and maintenance of tools and equipment **Problem-Based Learning:** Work in pairs to: 1. Let students come out with ways to prolong the life-span of various tools and equipment **NB.** Ensure all learners participate in all varieties of practical activities and project work given mixed gender groupings as well.	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	2.5.1.LI.3	2.5.1.AS.3

	Identify the various materials and accessories used for house wiring **Talk for learning/collaborative learning:** In mixed-ability or mixed-gender groups, guide learners to undertake the following activities: Identify materials and accessories required for carrying out house wiring and state the uses for each of them e.g.; different sizes of cables and accessories, protective devices, etc. **Problem-Based Learning:** Work in pairs to Determine the current-carrying capacity of the various cables Ensure all learners participate in all varieties of practical activities and project work given mixed gender groupings as well.	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	2.5.1.L1.4	2.5.1.AS.4
	Describe the sequence of Supply-control equipment in a consumer's premises **Talk for learning/collaborative learning:** In mixed-ability or mixed-gender groups, guide learners to undertake the following activities: 1. Describe of sequence of supply-control equipment (Service fuse, Meter, Mains switch, Distribution Board) 2. Explain the function of each equipment (eg Mains switch, for isolating the installation from the supply) **Problem-Based Learning:** Work in pairs to: 1. Draw the sequence of equipment and label them properly and indicate the function of each 2. Ensure all learners participate in all varieties of practical activities and project work given mixed gender groupings as well.	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	2.5.1.L1.5	2.5.1.AS.5
	Describe how a circuit is protected against Excess current **Talk for learning/collaborative learning:** In mixed-ability or mixed-gender groups, guide learners to undertake the following activities: 1. Explain excess current 2. Explain close and coarse protection 3. Differentiate between fuses and circuit breakers	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**

	4. Select appropriate Protective devices for various circuits eg 5A fuse for lighting. 30A fuse for cooker) **Problem-Based Learning:** Work in pairs to: Determine protective devices for various circuits 1. Determine how to select an appropriate protective device for each final circuit e.g. for lighting system 5A, cooker control unit 30A, socket outlet 20A, teaching them to adhere strictly to rules and regulations governing house wiring. 2. Compare and contrast fuses and circuit breakers 3. Outline the advantages and disadvantages of fuses and circuit breakers. 4. Ensure all learners participate in all varieties of practical activities and project work given mixed gender groupings as well	
	2.5.1.L1.6	2.5.1.AS.6
	Describe the various methods of house wiring **Talk for learning/collaborative learning:** In mixed-ability or mixed-gender groups, guide learners to undertake the following activities: • Describe the various methods of house wiring (Surface, conduit and trunking) • Compare and contrast the various methods of wiring • Outline the advantages and disadvantages of the various methods of wiring	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	2.5.1.L1.7	2.5.1.AS.7
	Wire final circuits in accordance with IEE regulations **Experiential Learning/Collaborative Learning:** Group learners and demonstrate to them the various ways of: • wiring simple circuits e.g. one lamp controlled by one switch. One lamp controlled by 2-way switching, one lamp controlled by 2-way and an intermediate switch. • Wiring socket outlets e.g. radial and ring circuits.	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	2.5.1.L1.8	2.5.1.AS.8
	Apply knowledge of final circuits in a practical situation **Project-Based Learning/Collaborative Learning:**	Level 1 Recall Level 2 Skills of conceptual understanding

	• In mixed-ability groups, task learner to undergo the following activities. • Design and make an extension board comprising two socket outlets; one lamp controlled by one switches and one lamp controlled by two switches.	**Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	2.5.1.L1.9	2.5.1.AS.9
	Earth an installation work in accordance with rules and regulations **Collaborative/ talk for learning: I**n mix-ability groups and with the use of the internet, task learners to undergo the following activities: • Explain the term 'earthing' • Outline the various reasons for earthing • Describe the Process of earthing **Experience learning/collaborative learning:** Engage learners in groups to conduct the following activities • Watch video on how earthing is done and write a report on the steps involved in earthing • Demonstrate the process of earthing	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	2.5.1.L1.10	2.5.1.AS.10
	Conduct relevant tests on an Installation that has been completed **Collaborative/talk for learning : in a mix- ability group task students to discuss** • Types of Test (eg: continuity test, Polarity test and Insulation Resistance test) • Importance of each type of test • Process of carrying out each test **Experience learning/collaborative learning:** • Engage learners in groups to conduct the following activities • Watch video on how testing is done and write a report on the steps involved in conducting each type of test. Demonstrate how to carry out each test.	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	2.5.1.L1.11	2.5.1.AS.11
	Apply the knowledge of house wiring in practical situations.	Level 1 Recall

	Experiential Learning Embark on a fieldtrip to sites where learners can observe how wiring is being carried out. **Project-based/collaborative learning** Using mixed gender groupings, engage learners to: • Carry-out wiring process on structures in accordance with rules and regulations			Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	2.5.1.L1.12			2.5.1.AS.12
	Apply the knowledge of house wiring in practical situations. **Experiential Learning** **Project-based/collaborative learning** • Using mixed gender groupings, engage learners to: • Carry-out wiring process on structures in accordance with rules and regulations			Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
Teaching and Learning Materials	• Cables • Trunkings	• conduit pipes • accessories	• megger • fittings	• multimeter

Subject APPLIED TECHNOLOGY
Strand 5. ELECTRICAL AND ELECTRONIC TECHNOLOGY
Sub-Strand 2. ELECTRONIC COMPONENTS AND CIRCUITS

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
2.5.2.LO.1		
Demonstrate knowledge and understanding of electronic components and use them to design and construct electronic circuits.	**Communication and Collaboration Skills** • Ability to express and share ideas during a whole class discussions and group works • Capable of speaking clearly in a group. **Critical Thinking and problem-solving skills** Being able to analyse, judge, and draw conclusions about the differences, similarities and application of the various types of electronic components. • Capability to imagine and plan a particular type of electronic component required for a specific job. • Capability to select a particular component to design a given electronic circuit. • Capability to think critically and solve problems associated with an electronic circuit. **Research and Computer Literacy Skills.** • The use of ICT tools such U- tube, to search for relevant information on the operation of transistors enhances the understanding of learners. • Ability to use ICT tools to surf the internet for information about transistors and their applications and present in class. • The ability of learners to design and simulate electronic circuits.	**GESI:** There are always a variety of learners in the classroom, each with their own requirements and difficulties. Therefore, it is crucial to make sure that all methods of teaching and learning encourage social inclusion and gender equality. Learners studying electronics who encounter these methods are more likely to: • Recognise and appreciate the output of each individual as they design electronic circuits to solve problems. • Be gender sensitive by exhibiting the designs of women as a way appreciating their efforts. • value and respect everyone's contribution to the design and construction of electronic circuits, especially those of the less privileged. **SEL:** Learners have been introduced to the educational strategies used to achieve social inclusion, social justice, and emotional regulation. Through SEL, learners are able to • have the determination to be able very good electronic circuit using electronic components. • be aware of his/her strength and weaknesses as far as the learning of the use transistors in designing circuits is concern in order to seek for help where necessary.

	Creativity and innovation: Ability to use new ideas to design and create new designs with electronic components.	• relate to other learners when group assignment is given. • manage his /her time very well when given individual assignment. **National Core values:** In order for a country to advance, its people must build a set of values that will propel the country's development. Particularly with competent individuals, values like patriotism, honesty, accountability, and hard work are necessary to assure advancement and growth in industries. Therefore, learners are anticipated to: • be taught to appreciate hard work, independence and determination when asked to do any piece of work • exhibit sense of responsibility in the care and maintenance of tools and equipment in the electrical workshop. • be honest and sincere when purchasing electronic components.

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
2.5.2.CS.1	2.5.2.LI.1	2.5.2.AS.1
Demonstrate understanding of Transistors as electronic devices and apply them in designing electronic circuits.	**Describe types resistor as a passive electronic component** **Collaborative Learning:** Using videos and pictures engage learners in mixed ability groups to undergo the following activities: 1. Define resistors 2. Outline the types of resistors e.g. wire wound, carbon resistors 3. Explain the functions of a resistor 4. Calculate the values of resistors using colour codes **Experiential Learning:** • Engage learners to work in mixed gender groups to use colour codes to calculate for the values of resistors and capacitors • Ensure all learners participate in all varieties of practical activities and project work given. Include mixed gender groupings as well	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	2.5.2.LI.2	2.5.2.AS.2
	Describe types capacitor as a passive electronic component **Collaborative Learning:** Using videos and pictures engage learners in mixed ability groups to undergo the following activities: 1. Define capacitor 2. Outline the types of capacitors e.g. Electrolytic, ceramic 3. Explain the functions of a capacitor 4. Calculate the values of capacitor using colour codes **Experiential Learning:** • Engage learners to work in mixed gender groups to use colour codes to calculate for the values of resistors and capacitors • Ensure all learners participate in all varieties of practical activities and project work given. Include mixed gender groupings as well.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	2.5.2.LI.3	2.5.2.AS.3
	Describe types inductor or as a passive electronic component	Level 1 Recall

	Collaborative Learning: Using videos and pictures engage learners in mixed ability groups to undergo the following activities: 1. Define inductor 2. Outline the types of inductors 3. Explain the functions of inductors **Collaboration and communication:** • Engage learners to work in mixed gender groups to determine functions of inductors in a circuit • Ensure all learners participate in all varieties of practical activities and project work given. Include mixed gender groupings as well.	**Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	2.5.2.LI.4	2.5.2.AS.4
	Describe the types of cells and their functions in circuits. **Collaborative Learning:** Use videos and pictures engage learners in mixed ability groups to undergo the following activities: 1. Define cell 2. Outline the types of cell 3. Explain the function of cells **Research and Collaboration:** Organise the learners into mixed ability or gender inclusive groups, task them to: 1. Define a cell and explain the composition of cells. 2. Discuss the various types of cells. 3. Explain how cells function in circuits	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
2.5.2.CS.1	2.5.2.LI.5	2.5.2.AS.5
Demonstrate understanding of Transistors as electronic devices and apply them in designing electronic circuits	**Illustrate the construction of transistors** **Experiential Learning:** Using videos (YouTube): Demonstrate to learners how the transistor is constructed. **Collaborative Learning:**	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning**

	• Engage learners to work in mixed gender groups to use the video to: • Describe the construction of the various transistors e.g. BJT (Bipolar junction transistor), FET (Field effect transistor), and Uni junction transistors • Explain the operation of each transistor and state their applications e.g. the BJT is used to build circuits such as the power amplifiers and security circuits.	Level 4 Extended critical thinking and reasoning
	2.5.2.LI.6	2.5.2.AS.6
	Illustrate the principles of operation of the various transistors. **Task learners to:** Explain the operation of the BJT transistors (PNP and NPN) and indicate the proper connection of each in a circuit. **Research and Collaboration** • Organise the learners into mixed ability or gender inclusive groups, task them to do the following activities and submit report. • Discuss the operations of the Field Effect Transistor (FET) e.g. Junction Field Effect Transistor (J- FET) and Metal Oxide Field Effect Transistor (MOSFET). • Differentiate between the operation of the J-FET and the MOSFET • Describe how the Uni-junction Transistor operates.	
	2.5.2.LI.7	2.5.2.AS.7
	Apply the principles and operation of transistors in designing circuits **Experiential Learning:** Engage learners using a mixed ability grouping to: • Select good transistors from faulty ones by testing and exhibit honesty in identifying good transistors from faulty ones. **Project- based learning** • Design, simulate (using multism software) and construct amplifier circuits using transistors e.g. voltage divider, class B and AB Push Pull exhibiting sense of responsibility in the care of tools and equipment given them.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
2.5.2.CS.1	2.5.2.LI.8	2.5.2.AS.8
Demonstrate knowledge and understanding of	Describe the types of control systems and give practical examples	Level 1 Recall

control system principles and how to use them	**Collaborative Learning/Talk for learning:** With the use of the internet, engage learners in mixed ability groups to undergo the following activities: • Explain control systems. • Outline the types of control systems and give examples i.e. Open loop e.g. Water heater, Electric Bulb, washing machine etc. and closed loop e.g. Toaster, refrigerator etc. • Through a whole class discussion, task learners to present their findings. **Experiential Learning/Project -based learning:** Engage learners to work in mixed gender groups to: • Draw the block diagrams of the types of control systems e.g. open loop and closed loop. • Outline the functions of each block.	**Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
2.5.2.CS.1	2.5.2.LI.9	2.5.2.AS.9
Demonstrate knowledge and understanding of Digital Electronics	**Solve problems on Binary operations** **Collaborative Learning:** With the use of the internet, engage learners in mixed ability groups to undergo the following activities: • explain Binary numbers **Experiential Learning/collaborative learning:** In mixed-ability groups task learners to: • Convert decimal number to binary number and vice versa • Convert binary to hexadecimal and vice versa.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
2.5.2.CS.1	2.5.2.LI.10	2.5.2.AS.10
Demonstrate knowledge and understanding of electronic measuring instrument and how to use them to take measurements	**Convert moving coil instrument into voltmeter and ammeter** **Collaborative Learning:** With the use of the internet, engage learners in mixed ability groups to undergo the following activities: • Explain principle of operation of the moving coil measuring instruments • Describe the construction of the Moving coil instruments. • Outline the advantages and disadvantages of the moving coil instrument	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning

	Experiential Learning: Engage learners to work in mixed gender groups to use shunts and multipliers to convert a moving coil instrument into • voltmeter • Ammeter	
	2.5.2.LI.11	2.5.2.AS.11
	Convert moving iron instrument into voltmeter and ammeter **Collaborative Learning:** With the use of the internet, engage learners in mixed ability groups to undergo the following activities: • Explain principle of operation of the moving iron measuring instruments • Describe the construction of the Moving iron instruments. • Outline the advantages and disadvantages of the moving iron instrument **Experiential Learning:** Engage learners to work in mixed gender groups to use shunts and multipliers to convert a moving iron instrument into • voltmeter • Ammeter	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning

	2.5.2.LI.12		2.5.2.AS.12
	Apply knowledge of electronic components in designing circuits **Proposed materials to be used:** **1.** Fire alarm circuit: • Resistors (470kω,100kω,and 1kω) • Capacitors (2.2μf, 100μf) • Diode (in4007) • Transistors (npn) (ac 128, bc 128) • Transistor (pnp) (bc 117) • Cell (9v) 2. Rain alarm circuit • Probes • Resistors (330kilohms,10kilohms) • Transistors. (bc548 and bc558) • Speaker • Capacitor. (0.1mircofarad) • Cell (3v)		Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
Teaching and Learning Materials	• Computers installed with multism software • Resistors, Capacitors, Inductors	• multimeters • the use of the internet	

YEAR THREE

Subject APPLIED TECHNOLOGY
Strand 1. AUTOMOTIVE TECHNOLOGY
Sub-Strand 1. INTRODUCTION TO ENGINE TECHNOLOGY

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
3.1.1.LO.1		
Analyse fuel supply, air intake, exhaust, supercharger and turbocharger systems for both spark ignition (SI) and compression ignition (CI) engines	**Communication and Collaboration skills**: • Learners express their ideas during pair and group work • Learners share ideas and respect each other in group and pair work • Presentation of both oral and written reports. • Respecting and accepting group members contribution • Through sharing ideas and teamwork in pair and group activities **Critical thinking and problem-solving skills**: • Brain-write, think-square-share or brainstorming involves imagination and probing. • Use of knowledge of resources to identify resources available to different socio-cultural background • Develop imagination, research and questioning skills.	**GESI:** Learners having experienced a teaching approach that ensures gender equality and social inclusion, where they work with each other in an inclusive way; cross-sharing knowledge and understanding among groups and individuals lead them to: • Respect individuals of different backgrounds. • Embrace diversity and practice inclusion. • Examine and dispel misconceptions/ myths about gender as they relate to technical education • Interrogate their stereotypes and biases about gender and the role men and women play in technical education • Identify injustice, especially in recognition of the contributions of different groups and individuals to the effective servicing and maintenance of the engine systems. • Value and promote health and safety in workshop and in society.

		SEL: All learning experiences related to engine technology should give learners the opportunities to develop the social emotional learning competencies, which include self-awareness, self-management, social awareness, relationship skills, and responsible decision-making. The teacher should implement the social emotional learning strategies to make sure that learners achieve each learning outcome in the engine technology and be • Reflecting about oneself and gaining confidence • Exhibiting motivation and SMART goal setting • Managing feelings, emotions and conflicts • Showing empathy and cooperation The following strategies may be adopted by the teacher in achieving SEL: • modelling emotional self-control and judgment • promotion of positive self-talk with self-made portraits of engineering practices • making of a vision board, coming up with respectful conversation starters for healthy debates • Encourage learners to write about the order of their activities and diversity presentations.

		National values: Fairness, hardwork, tolerance and respect for others. Discipline, honesty and pursuit of excellence.

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
3.1.1.CS.1	3.1.1.LI.1	3.1.1.AS.1
Demonstrate and apply knowledge in the working principles of fuel supply system for both spark ignition (SI) and compression ignition(C1) engines as well air intake and exhaust systems	**Describe the main components of fuel supply for both spark ignition (SI).** **Group work/collaborative:** • Learners brainstorm in fair mixed groups to passionately discuss with respect to others, the layout of fuel supply system for petrol engines and present report. E.g., For spark ignition (SI) engines - Fuel tank, Fuel filter, Fuel pump, Carburettor, etc. • Guide learners using appropriate sketches, charts or real objects to assist learners to identify and discuss the layout of the petrol injection system on a vehicle.	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	3.1.1.LI.2	3.1.1.AS.2
	Describe the main components of fuel supply for compression ignition(C1) engines **Group work/collaborative:** • Learners brainstorm in fair mixed groups to passionately discuss with respect to others the layout of fuel supply system for diesel engines and present report. E.g., For Compression ignition (C1) engines - Fuel tank, fuel filters, fuel injection pump, injectors, etc.	Level 1 Recall Level 2 Skills of conceptual understanding Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**
	3.1.1.LI.3	3.1.1.AS.3
	Explain air intake system of the engine and state the functions of the main components. **Problem based Learning:** Learners work independently or in a group to identify and brainstorm what goes in and out of an engine, how to get more of these things into the engine and present an honest individual results to the class for discussion.	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	3.1.1.LI.4	3.1.1.AS.4
	Describe the principle of supercharger and turbocharger. **Problem based Learning:** • Learners work independently or in a group to identify and brainstorm the principle of supercharger and turbocharger systems.	Level 1 Recall Level 2 Skills of conceptual understanding Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**

	• Assist learners to discuss what goes in and out of an engine, how to get more of these things into the engine and present an honest individual results to the class for discussion.	
	3.1.1.LI.5	3.1.1.AS.5
	Describe the main components of the vehicle exhaust systems **Research and Collaboration:** Organise the learners into mixed ability and gender inclusive groups, task them to research on the main components of the exhaust system and explain each one to a friend, and/or write out a short description to keep as evidence. E.g., Exhaust manifold, oxygen sensor, catalytic converter, muffler/silencer, exhaust pipes	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	3.1.1.LI.6	3.1.1.AS.6
	Discuss the function and types of catalytic converter **Project-based Learning:** Guide learners and assist them to identify the position of the catalytic converter in the real exhaust system and discuss the functions and the types of catalytic converter and write it down for class discussion. E.g., Two-way and three-way catalytic converter	Level 1 Recall Level 2 Skills of conceptual understanding Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**
Teaching and Learning Materials	• Chart or real objects • Sketches	• video/YouTube • industrial visit

Subject APPLIED TECHNOLOGY
Strand 1. AUTOMOTIVE TECHNOLOGY
Sub-Strand 2. INTRODUCTION TO VEHICLE TECHNOLOGY

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
3.1.2.LO.1		
Perform diagnosis and repair on vehicle electrical/electronic systems and analyse air conditioning system and safe motoring.	**Communication and Collaboration skills:** • As learners work in groups, they will exhibit ability to identify and analyse different points of view they hear in a discussion and explain how they are different. • Able to follow and take part in a group discussion and express opinions when called upon. • Understand other people's perspectives and prepare them for to function better in real-life social and work situation. **Critical thinking and problem-solving skills:** • Ability to seek additional information to build understanding will be applied in brainstorming activities. • Thinking rationally and clearly to solve problems. • Able to identify and analyse different points of view they hear in a discussion and explain how they are different **Digital literacy:** • Able to use ICT tools to search for relevant information confidently. • Digital literacy will be used in the diagnosis and class presentation. • Ability to create simple video and audio recordings.	**GESI:** Learners having experienced a teaching approach that ensures gender equality and social inclusion, where they work with each other in an inclusive way; cross-sharing knowledge and understanding among groups and individuals lead them to: • Respect individuals of different backgrounds. • Embrace diversity and practice inclusion. • Examine and dispel misconceptions/ myths about gender as they relate to technical education • Interrogate their stereotypes and biases about gender and the role men and women play in technical education • Identify injustice, especially in recognition of the contributions of different groups and individuals to the effective servicing and maintenance of vehicle systems. • Sensitive to the inter-relatedness of the various aspects of vehicle systems.

		• Value and promote health and safety in workshop and in society. **SEL:** All learning experiences related to vehicle technology should give learners the opportunities to develop the social emotional learning competencies, which include self-awareness, self-management, social awareness, relationship skills, and responsible decision-making. The teacher should implement the social emotional learning strategies to make sure that learners achieve each learning outcome in the vehicle technology and be • Reflecting about oneself and gaining confidence • Exhibiting motivation and SMART goal setting • Managing feelings, emotions and conflicts • Showing empathy and cooperation The following strategies may be adopted by the teacher in achieving SEL • modelling emotional self-control and judgment • promotion of positive self-talk with self-made portraits of engineering practices • making of a vision board, coming up with respectful conversation starters for healthy debates

		• Encourage learners to write about the order of their activities and diversity presentations. **National values:** Discipline, honesty, fairness, safety of welfare of the public and respect for others. Handwork, tolerance and pursuit of excellence.

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
3.1.2.CS.1	3.1.2.LI.1	3.1.2.AS.1
Demonstrate and apply knowledge in the working principles of fuel supply system for both spark ignition (SI) and compression ignition(C1) engines as well air intake and exhaust systems	**Describe batteries, ignition and starting motor systems of the vehicle.** **Experiential learning:** Learners visit a local repair or school workshop to observe and discuss the main electrical systems on the vehicle and write out a short description to keep as evidence. E.g., Battery, ignition system, starter motor system, etc.	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	3.1.2.LI.2	3.1.2.AS.2
	Describe charging system, lighting, auxiliary and instrument panel systems of the vehicle. **Experiential learning:** Learners visit a local repair or school workshop to observe and discuss the main electrical systems on the vehicle and write out a short description to keep as evidence. E.g., charging, lighting, auxiliary and instrument panel systems etc.	Level 1 Recall Level 2 Skills of conceptual understanding Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**
	3.1.2.LI.3	3.1.2.AS.3
	Explain basic automotive electronics and engine management systems. **Environmental observation and general discussion:** • Using charts, models and videos (YouTube), and real vehicle in the school workshop, engage learners in an inclusive class discussion to explain electronics components in the vehicle. E.g., transistorized and electronic ignition etc. • Discuss the use of OBD scan tools for vehicle diagnosis and present report for discussion.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	3.1.2.LI.4	3.1.2.AS.4
	Explain offboard and onboard diagnostics (OBD I & II) and the use of the scan tools. **Environmental observation and general discussion:** • Using charts, models and videos (YouTube), and real vehicle in the school workshop, engage learners in an inclusive class discussion to explain offboard and onboard diagnostics (OBD I & II) used in vehicle diagnosis.	Level 1 Recall Level 2 Skills of conceptual understanding Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**

	• Discuss the use of various scan tools for vehicle diagnosis and present report for discussion.	
	3.1.2.LI.5	3.1.2.AS.5
	Examine and describe the operation of the electric vehicle (EV). **Environmental observation and general discussion:** • Using charts, models and videos (YouTube), and real vehicle in the school workshop, learners identify and describe the main components of the electric vehicle. • Engage learners in an inclusive class discussion to explain the operation of the electric vehicle.	Level 1 Recall Level 2 Skills of conceptual understanding Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**
	3.1.2.LI.6	3.1.2.AS.6
	Describe the basic operation of the automotive HVAC system and safe motoring. **Problem-Based Learning:** Group learners to discuss automotive HVAC systems and present group report on the problem. Also, guide learners to discuss the procedure to diagnose and repair air condition system. E.g., Major components, compressor, condenser, receiver-dryer, expansion valve, evaporator **Group work/collaborative learning:** • In a fair mixed ability group assist learners to conduct various investigations/research to gather pieces of information regrading safe motoring • Assist learners to discuss and identify each of the safety devices on the vehicle for the driver and other road users, highway code and causes of road accidents.	Level 1 Recall Level 2 Skills of conceptual understanding Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**
Teaching and Learning Materials	• Chart or real object • sketches, video/YouTube	• industrial visit

Subject APPLIED TECHNOLOGY
Strand 2. METAL TECHNOLOGY
Sub-Strand 1. ENGINEERING MATERIALS, TOOLS AND MACHINES

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
3.2.1.LO.1		
Be able to use selected manual and computerised machines.	**Communication and Collaboration skills:** • Able to adapt their presentation to better engage the audience during its delivery • Assuming shared responsibility, cooperating and giving feedback. • As learners work in groups, they will exhibit the ability to identify and analyse different points of view they hear in a discussion and explain how they are different. **Critical thinking and problem-solving skills:** • Ability to seek additional information to build understanding will be applied in brainstorming activities. • Thinking rationally and clearly to solve problems. • Able to identify and analyse different points of view they hear in a discussion and explain how they are different **Digital literacy:** • Able to use ICT tools to search for relevant information confidently. • Digital literacy will be used in class presentation and CNC operations. • Ability to create simple video and audio recordings. • Ability to explore print and electronic media for information.	**GESI:** Learners having experienced a teaching approach that ensures gender equality and social inclusion, where they work with each other in an inclusive way; cross-sharing knowledge and understanding among groups and individuals lead them to: • Respect individuals of different backgrounds. • Embrace diversity and practice inclusion. • Examine and dispel misconceptions/ myths about gender as they relate to technical education • Interrogate their stereotypes and biases about gender and the role men and women play in technical education • Identify injustice, especially in recognition of the contributions of different groups and individuals to the effective engineering practices • Sensitive to the inter-relatedness of the various aspects of metal work technology. • Value and promote health and safety in workshop and in society.

		SEL: All learning experiences related to materials, tools and machines technology should give learners the opportunities to develop the social emotional learning competencies, which include self-awareness, self-management, social awareness, relationship skills, and responsible decision-making. The teacher should implement the social emotional learning strategies to make sure that learners achieve each learning outcome in the metal technology and be • Reflecting about oneself and gaining confidence • Exhibiting motivation and SMART goal setting • Managing feelings, emotions and conflicts • Showing empathy and cooperation The following strategies may be adopted by the teacher in achieving SEL: • modelling emotional self-control and judgment • promotion of positive self-talk with self-made portraits of engineering practices • making of a vision board, coming up with respectful conversation starters for healthy debates

		• Encourage learners to write about the order of their activities and diversity presentations. **National values:** • Discipline, fairness, and respect for others. • Handwork, accountability, integrity and tolerance.

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
3.2.1.CS.1	3.2.1.LI.1	3.2.1.AS.1
Demonstrate understanding of use and care for engineering tools and computerized machines	**Describe computing coding language used in Computer Numerical Control (CNC) machines** **Group work/collaborative learning:** Group learners to discuss computing coding language used in CNC using video or simulated activities and describe the computer language. Assist learners to enter the code into the CNC machines e.g. In G-code 5 main letters are used in this language. Each letter corresponds to a different type of action for the machine to execute. eg.M02: end of programme, M06: tool change, G02: clockwise etc.	Level 1 Recall **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
	3.2.1.LI.2	3.2.1.AS.2
	Describe the main features and perform operations using CNC turning machines. **Talk for learning approaches:** With video or simulation, learners are exposed to the various features of CNC lathe machine in the manufacturing industry and assist learners to effectively identify and describe the main features of the CNC lathe machine. **Experiential Learning:** In the school workshop or local manufacturing industry with learners or simulated activities, help learners to identify, observe and perform the operations using the CNC lathe machine	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	3.2.1.LI.3	3.2.1.AS.3
	Describe the main features and perform operations using CNC milling machine. **Talk for learning approaches:** With video or simulation, learners are exposed to the various features of CNC lathe machine in the manufacturing industry and assist learners to effectively identify and describe the main features of the CNC milling machine. **Experiential Learning:**	Level 1 Recall Level 2 Skills of conceptual understanding Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**

	In the school workshop or local manufacturing industry with learners or simulated activities, help learners to identify, observe and perform the operations using the CNC milling machine.	
	3.2.1.LI.4	3.2.1.AS.4
	Describe the main features and perform operations using CNC drilling and grinding machines. **Talk for learning approaches:** With video or simulation, learners are exposed to the various features of drilling and grinding machines in the manufacturing industry and assist learners to effectively identify and describe the main features of the CNC drilling and grinding machines. **Experiential Learning:** In the school workshop or local manufacturing industry with learners or simulated activities, help learners to identify, observe and perform the operations using the drilling and grinding machines.	Level 1 Recall Level 2 Skills of conceptual understanding Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**
	3.2.1.LI.5	3.2.1.AS.5
	Describe and perform operations using 3D printers. **Group work/collaborative learning:** Guide learners to perform design for manufacturability incorporating CAD applications used to create the model for 3D printers in mixed ability groups E.g., Creating a simple design on a sheet metal or wood and prototypes using 3D printers.	Level 1 Recall Level 2 Skills of conceptual understanding Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**
	3.2.1.LI.6	3.2.1.AS.6
	Describe and perform operations using lasers **Group work/collaborative learning:** Guide learners to perform design for manufacturability incorporating CAD applications used to create the model for lasers in mixed ability groups E.g., Creating a simple design or prototype on a sheet metal or wood using lasers.	Level 1 Recall Level 2 Skills of conceptual understanding Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**

Teaching and Learning Materials	• Chart • real object • CNC milling	• CNC lathe • 3D printer • video clips of CNC operations	• Industrial visit • CNC drilling	• CNC grinding • Laser

Subject APPLIED TECHNOLOGY
Strand 2. METAL TECHNOLOGY
Sub-Strand 2. WELDING TECHNOLOGY

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
3.2.2.LO.1		
Outline the basic techniques applied in design for manufacture	**Communication and Collaboration skills:** • As learners work in groups, they will exhibit the ability to identify and analyse different points of view they hear in a discussion and explain how they are different. • Able to follow and take part in a group discussion and express opinions when called upon. • Understand other people's perspectives and prepare them for to function better in real-life social and work situation **Critical thinking and Problem-solving skills:** • Ability to use justifiable methods to choose between the designs that they have created. • Apply knowledge to real life situations in the use of design techniques. • Able to identify and analyse different points of view they hear in a discussion and explain how they are different. • Apply their knowledge or make connections with what they learn in real life situations.	**GESI:** Learners having experienced a teaching approach that ensures gender equality and social inclusion, where they work with each other in an inclusive way; cross-sharing knowledge and understanding among groups and individuals lead them to: • Respect individuals of different backgrounds. • Embrace diversity and practice inclusion. • Examine and dispel misconceptions/ myths about gender as they relate to technical education • Interrogate their stereotypes and biases about gender and the role men and women play in technical education • Identify injustice, especially in recognition of the contributions of different groups and individuals to the effective welding practices • Sensitive to the inter-relatedness of the various aspects of welding and fabrication technology. • Value and promote health and safety in workshop and in society.

		SEL: All learning experiences related to welding technology should give learners the opportunities to develop the social emotional learning competencies, which include self-awareness, self-management, social awareness, relationship skills, and responsible decision-making. The teacher should implement the social emotional learning strategies to make sure that learners achieve each learning outcome in the welding technology and be • Reflecting about oneself and gaining confidence • Exhibiting motivation and SMART goal setting • Managing feelings, emotions and conflicts • Showing empathy and cooperation The following strategies may be adopted by the teacher in achieving SEL • modelling emotional self-control and judgment • promotion of positive self-talk with self-made portraits of engineering practices • making of a vision board, coming up with respectful conversation starters for healthy debates

		• Encourage learners to write about the order of their activities and diversity presentations. **National values:** Discipline, integrity, handwork, tolerance, accountability and respect for others**.** Sincerity, safety, welfare of the public and pursuit of excellence.

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
3.2.2.CS.1	3.2.2.LI.1	3.2.2.AS.1
Demonstrate understanding of the principles and special welding techniques in design for manufacture and entrepreneurship.	**Explain and perform the stages in design for manufacture.** **Group work/collaborative learning:** • In a fair mixed ability group, assist learners to conduct various investigations/research to gather pieces of information for generating possible solutions to a design problem using pictorial or conceptual drawing. • Assists learners to consider each of their three possible solutions by given criteria and select the most appropriate solution for manufacture or making in the workshop. • Guide learners to select appropriate tools and materials for making innovative new idea artefacts to the existing artefacts.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	3.2.2.LI.2	3.2.2.AS.2
	Describe the entrepreneurial skills in metal work. **Group work/collaborative learning:** • In a fair mixed ability group assist learners to conduct various investigations/research to gather pieces of information about entrepreneurial skills in metal work. • Guide learners to consider each entrepreneurial skill in metal work and put all the skills required in entrepreneurship into practice. **Project-based Learning:** With a given project, assist learners to make artefacts in groups or individual and demonstrate all the entrepreneurial skills.	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	3.2.2.LI.3	3.2.2.AS.3
	Describe and apply a simple soldering and brazing joint design for manufacture **Project-based Learning:** • Guide learners using charts, pictures, models, videos (YouTube), and real objects to discuss, observe and practice. various ways of applying soldering to artefacts. • Assist learners to apply brazing and soldering to make artefacts in groups or individuals.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning

	3.2.2.LI.4	3.2.2.AS.4
	Describe and apply mechanical fasteners and finishes in design for manufacture. **Group work/collaborative learning:** • In a fair mixed ability group assist learners to brainstorm and identify the various fasteners and finishes. • Guide learners to select and use the appropriate fasteners and finishes for a given design for manufacture. **Project-based Learning**: With a given project, assist learners to make artefacts in groups or individual and apply mechanical fasteners and finishes	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	3.2.2.LI.5	3.2.2.AS.5
	Explain special welding techniques used in design and manufacture. **Experiential learning:** Learners embark on educational visits to local welding shops, manufacturing industry and observe special welding techniques and present a report in the class. E.g., Spot welding. Gas Metal Arc Welding (GMAW) **Project-based Learning**: With a given project in groups or individual, assist learners to identify and use the appropriate special welding technique to make artefacts	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	3.2.2.AS.6	3.2.2.LI.6
	Explain special welding techniques used in oil and gas industry. **Group work/collaborative learning:** In mixed ability groups, assist learners to discuss the special welding processes used in the oil and gas industry. **Experiential learning:** Learners embark on educational visits to a local oil and gas industry and observe the use the special welding processes and present a report in the class.	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning

Teaching and Learning Materials	• real object • sketches /chart	• video/YouTube • industrial visit

Subject **APPLIED TECHNOLOGY**
Strand 3. **BUILDING CONSTRUCTION TECHNOLOGY**
Sub-Strand 2. **SUBSTRUCTURE AND SUPERSTRUCTURE**

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
3.3.2.LO.1		
Outline the purpose of Services and determine the schedule of works involved in installing Electricity, Cold-water and Waste disposal in a typical 3-bedroom self-contained house.	**Critical thinking skills:** • All Learners will apply their communication skills through oral or written presentations to explain reasons for providing Services in the building. • All Learners will rely on the knowledge of one another in describing the differences in basic Services which are provided in the building. • All Learners will participate in discussing the schedule of works involved in installing basic Services in the building.	**GESI:** Having benefited from pedagogical approaches which enhanced gender equality and social inclusion, Learners would be expected to: • Show respect to individuals of different backgrounds. • Acknowledge diversity and practice inclusion. • Repeal misconceptions/ myths about gender as they relate to one another within the Construction team. **SEL:** Creating opportunities for learners to build their Social Emotional Learning Competencies - *Self-Awareness, Self-Management, Social Awareness, Relationship Skills and Responsible Decisions* are integrated throughout all lessons to encourage inclusion. As part of achieving each learning outcome in the curriculum, the teacher should apply the social emotional learning strategies to ensure that learners are: • Self-reflecting about knowledge gathered and finding confidence in contributing to issues that crop up.

		• Exhibiting motivation, and SMART goal setting to achieve all academic ambitions no matter the challenges encountered. • Managing emotions and conflicts that may manifest as a result of different perceptions others may likely arise when brainstorming on the Services Topic. • Showing empathy and cooperation with colleagues that may be experiencing challenging circumstances. These may be done by the teacher through modelling emotional self-regulation and decision making, and the promotion of positive self-talk with self-made portraits, creation of a vision board, creating respectful icebreaker for healthy debates, encourage diversity presentations, and learners writing on the sequence of their activities. **National Values:** Cooperation, Commitment, Integrity, Honesty, Equality, Sincerity, Tolerance, Friendliness, Open mindedness, Hard work, Humility and Ethics.
3.3.2.LO.2		
Determine the basic finishes used for the different building Components of a simple three-bedroom self-contained house.	**Critical Thinking skills:** • All Learners will apply their communication skills through oral and/or written presentation to explain the meaning, functions and types of floor finishes. • All Learners will apply their communication skills through oral and/or written presentation to explain the meaning, functions and types of wall finishes.	**GESI:** Having benefited from pedagogical approaches which enhanced tremendous gender equality and social inclusion, be it at individual levels or group levels Learners would be expected to: • Show respect to individuals of different backgrounds. • Acknowledge diversity and practice inclusion.

	• All Learners will apply their communication skills through oral and/or written presentation to explain the meaning, functions and types of ceiling finishes. • All Learners will apply their communication skills through oral and/or written presentation to explain the meaning, functions and types of roof finishes. **Creativity skills:** • All learners will apply collaboration skills through oral or written means to select or specify floor finishes based on the functions of the space. • All learners will apply collaboration skills through oral or written means to select or specify wall finishes based on the functions of the space. • All learners will apply collaboration skills through oral or written means to select or specify ceiling finishes based on the functions of the space. • All learners will apply collaboration skills through oral or written means to select or specify roof finishes based on the functions and environment of the building.	• Repeal misconceptions/ myths about gender as they relate to one another within the Construction team. **SEL:** Creating opportunities for learners to build their Social Emotional Learning Competencies - *Self-Awareness, Self-Management, Social Awareness, Relationship Skills and Responsible Decisions* are integrated throughout all lessons to encourage inclusion. As part of achieving each learning outcome in the curriculum, the teacher should apply the social emotional learning strategies to ensure that learners are: • Self-reflecting about knowledge gathered and finding confidence in contributing to issues that crop up. • Exhibiting motivation, and SMART goal setting to achieve all academic ambitions no matter the challenges encountered. • Managing emotions and conflicts that may manifest as a result of different perceptions others may likely arise when brainstorming on the Services Topic. • Showing empathy and cooperation with colleagues that may be experiencing challenging circumstances. The teacher can achieve these through: • class discussions and recognition of the contributions of all on the different types of finishes used in building construction.

		• Motivating learners to come out and share their views on types and uses of finishes. • teaching learners to develop decision-making skills **National Values:** Cooperation, Commitment, Integrity, Honesty, Equality, Sincerity, Tolerance, Friendliness, Open mindedness, Hard work, Humility, Objectivity, Passion.

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
3.3.2.CS.1	3.3.2.LI.1	3.3.2.AS.1
Demonstrate Knowledge and understanding of basic Services.	**Discuss the reasons for Providing Services.** **Communication:** Organize a whole class and let learners explain the meaning of Services. **Collaboration:** • Organize a whole class and let learners outline different types of services provided in the building. This is a brainstorming method that involves critical thinking among Learners as they discuss and find reasons for Providing Services in the building. • Organize a whole class and let learners explain the purposes of providing Services in the building. This is a brainstorming method that involves critical thinking among Learners as they discuss and find reasons for Providing Services in the building. **Experiential Learning:** Embark on field trips to any Estate Development Premises for Learners to observe or learn about the benefits in providing Services in a house; • They will observe how, among other functions, Electricity Supply helps to provide Visual comfort through artificial lighting and Thermal Comfort through the use of Air-Conditioners in the interior space. • They will observe how, among other functions, Cold Water Installation or supply provides water through the taps for drinking. • They will observe how sanitation is ensured by disposing liquid and solid waste through the WC, manhole, septic tank, soak-aways and the public drain system.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	3.3.2.LI.2	3.3.2.AS.2
	Distinguish Electricity Supply, Cold-Water Installation and Waste Disposal as different forms of Services. **Collaboration:** Ask learners in mixed ability groups to distinguish between the major basic Services in the building as; 1. Cold-water Supply which provides cold water from the company's main to fixtures and fittings such as taps using appropriate sizes of pipes and jointing so as to prevent leakage and loss of pressure in the system.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning

	2. Electricity Supply which conducts electrical energy to fixtures, fittings and appliances such as air-conditioners and Lighting bulbs through cables with adequate insulations so as not to allow leakage and cause electric shocks. 3. Waste Disposal System which ensures sanitation by disposing liquid and solid waste through the WC, manhole, septic tank, soak-aways and the public drain system. This method is to facilitate effective participation by different Learners, namely, the Approaching Proficiency, the Proficient and the Highly Proficient.	
	3.3.2.LI.3	3.3.2.AS.3
	Explain the schedule of works involved in installing Electricity. **Communication:** Organize a whole class and let learners outline the schedule of tasks involved in installing electricity. **Collaboration:** Identification of ability and positioning to ensure mixed ability. Through structured grouping [GESI] ask Learners to discuss the schedule of works involved in the installation of electricity in the building. This method is to ensure effective participation in teaching and learning by different categories of Learners including Approaching Proficiency, the Proficient and the Highly Proficient. **Experiential Learning:** Embark on a field trip to a Site where installation of electricity is going on for Learners to observe or learn about schedule of works involved in the installation of electricity. **For Electricity Supply Learners will observe and report on;** 1. The agreement signed by both Services providers and the Owner of the property. 2. The variety of materials, appliances, fixtures and fittings such as poles, cables of different sizes, meter, consumer unit with circuit breakers, earthing materials and thunder arresting materials etc. provided for installing Electricity. 3. The order or sequence of installing these fixtures and appliances. 4. The safety precautions integrated by including wiring for earthing, lightning arrestor and circuit breakers. 5. The ducts, trunking and excavations done to contain service lines	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning

	3.3.2.LI.4	3.3.2.AS.4
	Explain the schedule of works involved in installing Cold Water. **Communication:** Organize a whole class and let learners outline the schedule of tasks involved in Cold-water Supply **Collaboration:** Identification of ability and positioning to ensure mixed ability. Through structured grouping [GESI] ask Learners to discuss the schedule of works involved in Cold-water Supply to the building. This method is to ensure effective participation in teaching and learning by different categories of Learners including Approaching Proficiency, the Proficient and the Highly Proficient. **Experiential Learning:** Embark on a field trip to a Site where Services Works are going on for Learners to observe or learn about schedule of works involved in the installation of Cold-water Supply. **For Cold Water Supply Learners will observe and report on;** 1. The agreement signed by both Services providers and the Owner of the property. 2. The variety of materials, appliances, fixtures and fittings such as pipes of different sizes, meter, stop valves, storage cisterns, taps etc. provided for water supply. 3. The order or sequence of installing these fixtures and appliances. 4. The ducts, trunking and excavations done to contain service lines.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	3.3.2.LI.5	3.3.2.AS.5
	Explain the schedule of works involved in installing Waste Disposal. **Communication:** Organize a whole class and let learners distinguish between liquid waste and solid waste. **Collaboration:** • Identification of ability and positioning to ensure mixed ability. Through structured grouping [GESI] ask Learners to discuss the schedule of works involved in disposal of liquid waste. This method is to ensure effective participation in teaching and learning	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning

	by different categories of Learners including Approaching Proficiency, the Proficient and the Highly Proficient. • Identification of ability and positioning to ensure mixed ability. Through structured grouping [GESI] ask Learners to discuss the schedule of works involved in disposal of solid waste. This method is to ensure effective participation in teaching and learning by different categories of Learners including Approaching Proficiency, the Proficient and the Highly Proficient. **Experiential Learning:** Embark on a field trip to a Site where Services Works are going on for Learners to observe or learn about schedule of works involved in the installation of waste disposal services. **For Waste Disposal (Solid and Liquid) Learners will observe and report on;** 1. The variety of materials, appliances, fixtures and fittings such as drain pipes and valves of different sizes, WCs etc. provided for disposal of Waste. 2. The order or sequence of installing these fixtures and appliances. 3. The construction of manholes to change direction and regulate gradient of flow, septic tank and soak-aways to treat solid waste and internal drains to link public drains	
	3.3.2.LI.6	3.3.2.AS.6
	Explain surface drainage system **Collaboration:** Identification of ability and positioning to ensure mixed ability. Through structured grouping [GESI] ask Learners to explain surface drainage system. This method is to ensure effective participation in teaching and learning by different categories of Learners including Approaching Proficiency, the Proficient and the Highly Proficient. **Collaboration:** Identification of ability and positioning to ensure mixed ability. Through structured grouping [GESI] ask Learners to outline types of surface drainage system. **Collaboration:** Identification of ability and positioning to ensure mixed ability. Through structured grouping [GESI] ask Learners to discuss the benefits of surface drainage system.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning

	Experiential Learning: Embark on a field trip to an estate development Site where surface water drain system is been installed for Learners to observe and learn about surface drainage. E.g. types of surface drains, i.e. combined and separate system.	
Teaching and Learning Materials	• Surfing on the Internet to find information about Services in the Building. • The use of simulation (virtual) to illustrate the functioning of Services installations in the building. • The use of Flip Charts with Services Lay-Out Plans to show distribution of basic services in the building.	

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
3.3.2.CS.2	3.3.2.LI.1	3.3.2.AS.1
Demonstrate Knowledge and understanding of finishes to buildings.	**Discuss finishes.** **Communication:** Organize whole class and ask learners to explain the meaning of finishes. This is a brainstorming method that elicits critical thinking among learners as they discuss and come out with the meaning and functions of finishes to buildings. **Collaboration:** • In mixed ability groups ask learners to discuss types of finishes and components they are applied to. This method is to ensure effective participation by different learners (GESI) in teaching and learning, including the Approaching Proficiency, the Proficient and the Highly Proficient. • In mixed ability groups ask learners to discuss functions of finishes. This method is to ensure effective participation by different learners (GESI) in teaching and learning, including the Approaching Proficiency, the Proficient and the Highly Proficient. **Experiential Learning:** Embark on field trips to Construction Sites or Sales Halls where Finishes are applied or sold. Learners will observe, feel and learn about finishes. The appropriate finishes that can be applied to a given building component and types of accessories, adhesives, materials, tools and equipment to be used in applying the finishes can be seen.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
.	3.3.2.LI.2	3.3.2.AS.2
	Discuss finishes applied to the Floor. **Communication:** Organize whole class and ask learners to select the finishes to apply given the specific space involved. This is a brainstorming method that elicits critical thinking among learners as they sincerely discuss and come out with the meaning, functions and types of finishes for floors. **Collaboration:** In mixed ability groups ask learners to discuss the construction technologies involved in the application of specific finishes to be used. This method is to ensure effective participation by different learners (GESI) in teaching and learning, including the Approaching Proficiency, the Proficient and the Highly Proficient.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning

	Exemplars: Floor finishes; Sand Cement Screed, Tiles, Terrazzo, Wood flooring and Paint. Types of adhesives, accessories, tools and equipment to be used. **Collaboration:** In mixed ability groups ask learners to discuss the types of adhesives, accessories, tools and equipment to be used to enhance the efficiency in the application of the finish. This method is to ensure effective participation by different learners (GESI) in teaching and learning, including the Approaching Proficiency, the Proficient and the Highly Proficient. **Experiential Learning:** Embark on field trips to Construction Sites or Sales Halls where Floor Finishes are sold. Learners will observe, feel and learn about; 1. The appropriate finish to apply to the floor given the functions of the space 2. Construction technology such as curing time and processes used in the application of the finishes; 3. Types of adhesives, materials, tools and equipment used to apply the finishes.	
	3.3.2.LI.3	3.3.2.AS.3
	Discuss finishes applied to walls. **Communication:** Organize whole class and ask learners to select the finishes to apply given the specific wall involved. This is a brainstorming method that elicits critical thinking among learners as they sincerely discuss and come out with the appropriate finishes. **Collaboration:** • In mixed ability groups ask learners to discuss the construction technologies involved in the application of specific finishes to be used. This method is to ensure effective participation by different learners (GESI) in teaching and learning, including the Approaching Proficiency, the Proficient and the Highly Proficient. • In mixed ability groups ask learners to discuss the types of adhesives, accessories, tools and equipment to be used to enhance efficiency othe application of the finish. This method is to ensure effective participation by different learners (GESI) in teaching and learning, including the Approaching Proficiency, the Proficient and the Highly Proficient.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning

	Experiential Learning: Embark on field trips to Construction Sites or Sales Halls where wall Finishes are sold. Learners will observe, feel and learn about; 1. The appropriate finish to apply to the wall given the functions of the space 2. Construction technology such as curing time and processes used in the application of the finishes; 3. Types of adhesives, materials, tools and equipment used to apply the finishes.	
	3.3.2.LI.4	3.3.2.AS.4
	Discuss finishes applied to Roof Carcasses. **Communication:** Organize whole class and ask learners to select the finishes to apply given the specific roof and geographical environment involved. This is a brainstorming method that elicits critical thinking among learners as they sincerely discuss and come out with the appropriate finishes. **Collaboration:** • In mixed ability groups ask learners to discuss the construction technologies involved in the application of specific finishes to be used. This method is to ensure effective participation by different learners (GESI) in teaching and learning, including the Approaching Proficiency, the Proficient and the Highly Proficient. • In mixed ability groups ask learners to discuss the types of adhesives, accessories, tools and equipment to be used to enhance efficiency in the application of the finish. This method is to ensure effective participation by different learners (GESI) in teaching and learning, including the Approaching Proficiency, the Proficient and the Highly Proficient. **Exemplars:** Micro Concrete Roofing Tiles, Wwooden shingles, Translucent Roofing Sheets, Thatch, Corrugated Aluminum or Galvanized sheets. **Experiential Learning:** Embark on field trips to Construction Sites or Sales Halls where Roof Finishes are applied or sold. Learners will observe, feel and learn about; 1. The appropriate finish to apply to the roof given the functions of the space 2. The appropriate finish to apply to the roof given the geographical location of the building.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning

	3. Construction technology such as curing time and processes used in the application of the finishes; 4. Types of adhesives, materials, tools and equipment used to apply the finishes.	
	3.3.2.LI.5	3.3.2.AS.5
	Discuss finishes applied to Ceiling joists **Communication:** Organize whole class and ask learners to select the finishes to apply given the specific space involved. This is a brainstorming method that elicits critical thinking among learners as they sincerely discuss and come out with the appropriate finishes. **Collaboration:** • In mixed ability groups ask learners to discuss the construction technologies involved in the application of the specific finishes to be used. This method is to ensure effective participation by different learners (GESI) in teaching and learning, including the Approaching Proficiency, the Proficient and the Highly Proficient. • In mixed ability groups ask learners to discuss the types of adhesives, accessories, tools and equipment to be used to enhance efficiency in the application of the finish. This method is to ensure effective participation by different learners (GESI) in teaching and learning, including the Approaching Proficiency, the Proficient and the Highly Proficient. **Exemplars:** Ceiling Finishes; Plywood, Soft Boards, Timber T&G, Paint, Plaster of Paris (P.O.P) **Experiential Learning:** Embark on field trips to Construction Sites or Sales Halls where Ceiling Finishes are applied or sold. Learners will observe, feel and learn about; 1. The appropriate finish to apply to the Ceiling given the functions of the Space; 2. Construction technology processes used in the application of the finishes; 3. Types of accessories adhesives, materials, tools and equipment used to apply the finishes.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	3.3.2.LI.6	3.3.2.AS.6
	Discuss finishes applied to fascia's, railing and plinth of building.	Level 1 Recall

	Communication: Organize whole class and ask learners to select the finishes to apply given the specific components involved. This is a brainstorming method that elicits critical thinking among learners as they sincerely discuss and come out with the appropriate finishes. **Collaboration:** • In mixed ability groups ask learners to discuss the construction technologies involved in the application of the specific finishes to be used. This method is to ensure effective participation by different learners (GESI) in teaching and learning, including the Approaching Proficiency, the Proficient and the Highly Proficient. • In mixed ability groups ask learners to discuss the types of adhesives, accessories, tools and equipment to be used to enhance efficiency in the application of the finish. This method is to ensure effective participation by different learners (GESI) in teaching and learning, including the Approaching Proficiency, the Proficient and the Highly Proficient. **Experiential Learning:** Embark on field trips to Construction Sites or Sales Halls where Finishes are applied or sold. Learners will observe, feel and learn about; 1. The appropriate finish to apply to the Components given the use of the building. 2. The appropriate finish to apply to the Components given the geographical location of the building. 3. Construction technology processes used in the application of the finishes 4. Types of accessories adhesives, materials, tools and equipment used to apply the finishes.	**Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
Teaching and Learning Materials	• Surfing on the Internet to find finishes used on buildings • The use of simulation (virtual) to illustrate functions of finishes on building • Charts,	• Pictures • Illustrations	• Sample of finishes • Scale models.

Subject APPLIED TECHNOLOGY
Strand 4. WOOD TECHNOLOGY
Sub-Strand 1. TOOLS AND MACHINES IN WOODWORK INDUSTRY

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
3.4.1.LO.1		
Be able to select and use appropriate machine for a specific operation independently	**Critical thinking and Problem solving, Communication, Collaboration and Leadership skills:** The group activities develop critical thinking and problem solving, literacy, communication, and collaboration **Digital Literacy:** The surf for videos from YouTube on the uses of machines develops digital literacy **Critical Thinking:** Assessment level 3 facilitates Strategic Thinking/ Reasoning and assessment level 4 facilitates the development of Extended Critical Thinking	**GESI:** Having encountered gender equality and social inclusion-based teaching pedagogy, where each student is important and affected by the learning activities which reinforce knowledge and skill acquisition, it is expected that students and groups will: • Emphasize on attitudes and values that promote gender equality and social inclusion. • Balance representation of males and females and all marginalized groups in the content. • Appreciate mixed ability and socio-economic backgrounds. • Embrace differentiated teaching and assessment building on consideration of prior learning of learners. • Engaged equally regardless of their socio-economic background and religion. • Personalize and inculcate core values and skills in wood technology for personal and national development.

		SEL: Learners have been taking through teaching modules that ensure social inclusion, social justice and emotional mastery. Through social emotional skills, learners were able to: • understand their own emotions, thoughts, values and are able to determine how their behavior is affected across various situations. • communicate clearly, listen actively, cooperate, resist inappropriate social pressure and negotiate conflict constructively. • make responsible and caring choices about personal behavior and social interactions . **National Values:** Self-Control, Open-mindedness, Passion, Responsibility, Co-operation, Work Ethics, Cleanliness, Patience and Tolerance.

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
3.4.1.CS.1	3.4.1.LI.1	3.4.1.AS.1
Demonstrate the ability to use woodwork Machines.	**Select an appropriate machine for a specific operation independently.** **Group work/Collaborative Learning:** Guide learners in mixed ability groups to co-operatively and passionately identify the following machines: 1. Mortising/Drilling Machine 2. Router Shaping Machine 3. Grinding Machine 4. Lathe Machine. 5. Drum sander Machine **Organise learners in mixed gender groups to co-operatively and passionately:** Identify and describe the parts of the following machines with open-mindedness: 1. Mortising/Drilling Machine 2. Router Shaping Machine 3. Grinding Machine 4. Lathe Machine. 5. Drum sander Machine **Group work/Collaborative Learning /Critical Thinking and Talk for Learning Approaches:** Assist learners in mixed ability groups to co-operatively and open-mindedness discuss the uses of the following woodwork machines: 1. Mortising/Drilling Machine 2. Router Shaping Machine 3. Grinding Machine 4. Lathe Machine. 5. Drum sander Machine **Digital Literacy learning:** Task learners to passionately use search engines (YouTube) to surf for videos on the uses of the following CNC machines open-mindedness: 1. Mortising/Drilling Machine 2. Router Shaping Machine 3. Grinding Machine 4. Lathe Machine.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning

	5. Drum sander Machine **Experiential learning/ Group work/Collaborative Learning:** • Guide learners in groups to co-operatively and open-mindedness select appropriate machine and use it properly taking into consideration work ethics and self-control. • Task learners in mixed gender ability groups to co-operatively discuss the care and maintenance of woodwork machines with open-mindedness. • Task learners to courageously practice how to care for and maintain woodwork machines taking into consideration work ethics and self-control.	
	3.4.1.LI.2	3.4.1.AS.2
	Use an appropriate machine for a specific operation independently **Group work/Collaborative Learning:** Guide learners in mixed ability groups to co-operatively and passionately identify the following machines: 1. Mortising/Drilling Machine 2. Router Shaping Machine 3. Grinding Machine 4. Lathe Machine. 5. Drum sander Machine **Organise learners in mixed gender groups to co-operatively and passionately:** Identify and describe the parts of the following machines with open-mindedness: 1. Mortising/Drilling Machine 2. Router Shaping Machine 3. Grinding Machine 4. Lathe Machine. 5. Drum sander Machine **Group work/Collaborative Learning /Critical Thinking and Talk for Learning Approaches:** Assist learners in mixed ability groups to co-operatively and open-mindedness discuss the uses of the following CNC woodwork machines: 1. Mortising/Drilling Machine 2. Router Shaping Machine 3. Grinding Machine 4. Lathe Machine.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning

	5. Drum sander Machine **Digital Literacy learning:** Task learners to passionately use search engines (YouTube) to surf for videos on the uses of the following CNC machines open-mindedness: 1. Mortising/Drilling Machine 2. Router Shaping Machine 3. Grinding Machine 4. Lathe Machine. 5. Drum sander Machine **Experiential learning/ Group work/Collaborative Learning:** • Guide learners in groups to co-operatively and open-mindedness select appropriate machine and use it properly taking into consideration work ethics and self-control. • Task learners in mixed gender ability groups to co-operatively discuss the care and maintenance of woodwork machines with open-mindedness. • Task learners to courageously practice how to care for and maintain woodwork machines taking into consideration work ethics and self-control.	
	3.4.1.LI.3	3.4.1.AS.3
	Demonstrate how to care for and maintain machines **Group work/Collaborative Learning:** Guide learners in mixed ability groups to co-operatively and passionately identify the following machines: 1. Mortising/Drilling Machine 2. Router Shaping Machine 3. Grinding Machine 4. Lathe Machine. 5. Drum sander Machine **Organise learners in mixed gender groups to co-operatively and passionately:** Identify and describe the parts of the following machines with open-mindedness: 1. Mortising/Drilling Machine 2. Router Shaping Machine 3. Grinding Machine 4. Lathe Machine. 5. Drum sander Machine	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning

	Group work/Collaborative Learning /Critical Thinking and Talk for Learning Approaches: Assist learners in mixed ability groups to co-operatively and open-mindedness discuss the uses of the following woodwork machines: 1. Mortising/Drilling Machine 2. Router Shaping Machine 3. Grinding Machine 4. Lathe Machine. 5. Drum sander Machine **Digital Literacy learning:** Task learners to passionately use search engines (YouTube) to surf for videos on the uses of the following sawing machines open-mindedness: 1. Mortising/Drilling Machine 2. Router Shaping Machine 3. Grinding Machine 4. Lathe Machine. 5. Drum sander Machine **Experiential learning/ Group work/Collaborative Learning:** • Guide learners in groups to co-operatively and open-mindedness select appropriate machine and use it properly taking into consideration work ethics and self-control. • Task learners in mixed gender ability groups to co-operatively discuss the care and maintenance of woodwork machines with open-mindedness. • Task learners to courageously practice how to care for and maintain woodwork machines taking into consideration work ethics and self-control.		
Teaching and Learning Materials	• Drilling Machine, • Mortising Machine • Shaping Machine	• Grinding Machine • Lathe Machine. • Chart/models and pictures of the above machines.	• Videos from YouTube on the uses of the following machines: Drilling Machine, Mortising Machine, Shaping Machine, Grinding Machine, Lathe Machine. • Oil, Rag, Duster, Screw driver, etc.

Subject APPLIED TECHNOLOGY
Strand 4. WOOD TECHNOLOGY
Sub-Strand 2. MATERIALS AND ARTEFACTS PRODUCTION IN WOODWORK INDUSTRY IN GHANA

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
3.4.2.LO.1		
Demonstrate knowledge and understanding of Sustainable Timber Industry in Ghana.	**Critical Thinking:** The brainstorming by the whole class session leads to critical thinking **Critical thinking and Problem solving, Communication, Collaboration and Leadership skills:** The group activities develop critical thinking and problem solving, literacy, communication, collaboration and leadership skills. **Digital Literacy:** The surfing for videos on the YouTube on the availability and sources of LKS, LUS Timber species and Non-Timber Forest Products (NTFP) develops digital literacy. **Critical Thinking:** The assessment level 3 facilitates strategic Thinking/Reasoning and assessment level.	**GESI:** Having encountered gender equality and social inclusion-based teaching pedagogy, where each student is important and affected by the learning activities which reinforce knowledge and skill acquisition, it is expected that students and groups will: • Emphasize on attitudes and values that promote gender equality and social inclusion. • Balance representation of males and females and all marginalized groups in the content. • Appreciate mixed ability and socio-economic backgrounds. • Embrace differentiated teaching and assessment building on consideration of prior learning of learners. • Engaged equally regardless of their socio-economic background and religion. • Personalize and inculcate core values and skills in wood technology for personal and national development.

Demonstrate knowledge and understanding of mass production, environmental impact and entrepreneurship Industry in Ghana.	**Critical Thinking:** The brainstorming by the whole class session leads to critical thinking **Critical thinking and Problem solving, Communication, Collaboration and Leadership skills:** The group activities develop critical thinking and problem solving, literacy, communication, collaboration and leadership skills. **Digital Literacy:** The surfing for videos on the YouTube on mass production, environmental impact and entrepreneurship develops digital literacy. **Critical Thinking:** The assessment level 3 facilitates strategic Thinking/Reasoning and assessment level.	**SEL:** Creating opportunities for learners to build their Social Emotional Learning Competencies - *Self-Awareness, Self-Management, Social Awareness, Relationship Skills and Responsible Decisions* are integrated in wood technology to encourage inclusion. As part of achieving each learning outcome in the curriculum, the teacher should apply the social emotional learning strategies to ensure that learners are: • Self-reflecting and finding confidence • Exhibiting motivation, and SMART goal setting • Managing emotions and conflicts • Showing empathy and cooperation These may be done by the teacher though modelling emotional self-regulation and decision making, and the promotion of positive self-talk with self-made portraits, creation of a vision board, creating respectful icebreaker for healthy debates, encourage diversity presentations, and learners writing on the sequence of their activities. **National Value:** Self-Control, Open-mindedness, Passion, Responsibility, Co-operation, Work Ethics, Cleanliness, Patience, Tolerance.

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
3.4.2.CS.1	3.4.2.LI.1	3.6.2.AS.1
Demonstrate knowledge and understanding of Sustainability of Timber Industry in Ghana	**Determine the availability and sources of Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS)** **Critical Thinking and Talk for Learning Approaches:** Guide learners through whole class session to brainstorm the meaning of the following with open-mindedness: 1. Lesser-Known Timber Species (LKS) 2. Lesser-Used Timber Species (LUS) **Group work/Collaborative Learning:** • Organise learners into mixed gender ability groups and assist them to co-operatively and open-mindedness, classify timber into: 1. Lesser-Known timber species (LKS) 2. Lesser-Used timber species (LUS) • Assist learners with open-mindedness in mixed ability groups to co-operatively discuss the uses of: 1. Lesser-Known timber species (LKS) 2. Lesser-Used timber species (LUS) **Digital Literacy learning:** Task learners to passionately with open-mindedness use search engines (YouTube) to surf for videos on the availability and sources of LKS and LUS Timber species.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
	3.4.2.LI.2	3.6.2.AS.2

	Classify Lesser-Known Timber Species (LKS), Lesser-Used Timber Species (LUS) **Critical Thinking and Talk for Learning Approaches:** Guide learners through whole class session to brainstorm the meaning of the following with open-mindedness: 3. Lesser-Known Timber Species (LKS) 4. Lesser-Used Timber Species (LUS) **Group work/Collaborative Learning:** • Organise learners into mixed gender ability groups and assist them to co-operatively and open-mindedness, classify timber into: 3. Lesser-Known timber species (LKS) 4. Lesser-Used timber species (LUS) • Assist learners with open-mindedness in mixed ability groups to co-operatively discuss the uses of: 3. Lesser-Known timber species (LKS) 4. Lesser-Used timber species (LUS) **Digital Literacy learning:** Task learners to passionately with open-mindedness use search engines (YouTube) to surf for videos on the availability and sources of LKS, LUS Timber species and Non-Timber Forest Products (NTFP)	**Level 1 Recall** **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	3.4.2.LI.3	3.6.2.AS.3
	Discuss the uses of Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) **Critical Thinking and Talk for Learning Approaches:** Guide learners through whole class session to brainstorm the meaning of the following with open-mindedness: 1. Lesser-Known Timber Species (LKS) 2. Lesser Used Timber Species (LUS) **Group work/Collaborative Learning:** • Organise learners into mixed gender ability groups and assist them to co-operatively and open-mindedness, classify timber into:	**Level 1 Recall** Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning

	1. Lesser-Known timber species (LKS) 2. Lesser Used timber species (LUS) • Assist learners with open-mindedness in mixed ability groups to co-operatively discuss the uses of: 1. Lesser-Known timber species (LKS) 2. Lesser Used timber species (LUS) **Digital Literacy learning:** Task learners to passionately with open-mindedness use search engines (YouTube) to surf for videos on the availability and sources of LKS, LUS Timber species	
	3.4.2.LI.4	3.6.2.AS.4
	Identify the source of NTFPs using desk top study (google search engine and You Tube) **Critical Thinking and Talk for Learning Approaches:** Guide learners through whole class session to brainstorm the meaning of NTFPs with open-mindedness. **Group work/Collaborative Learning:** • Organise learners into mixed gender ability groups and assist them to co-operatively and open-mindedness, identify the source of NTFPs. • Assist learners with open-mindedness in mixed ability groups to co-operatively discuss the uses of Non-Timber Forest Products (NTFP). **Digital Literacy learning:** Task learners to passionately with open-mindedness use search engines (YouTube) to surf for videos on the availability and sources of Non-Timber Forest Products (NTFP).	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
	3.4.2.LI.5	3.6.2.AS.5
	Classify Non-Timber Forest Products (NTFPs). **Critical Thinking and Talk for Learning Approaches:** Guide learners through whole class session to brainstorm the meaning of NTFPs with open-mindedness.	**Level 1 Recall** Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning**

	Group work/Collaborative Learning: • Organise learners into mixed gender ability groups and assist them to co-operatively and open-mindedness, identify the source of NTFPs. • Assist learners with open-mindedness in mixed ability groups to co-operatively discuss the uses of Non-Timber Forest Products (NTFP). **Digital Literacy learning:** Task learners to passionately with open-mindedness use search engines (YouTube) to surf for videos on the availability and sources of Non-Timber Forest Products (NTFP).	Level 4 Extended critical thinking and reasoning
	3.4.2.LI.6	3.6.2.AS.6
	Discuss the uses of Non-Timber Forest Products (NTFPs). **Critical Thinking and Talk for Learning Approaches:** Guide learners through whole class session to brainstorm the meaning of NTFPs with open-mindedness. **Group work/Collaborative Learning:** • Organise learners into mixed gender ability groups and assist them to co-operatively and open-mindedness, identify the source of NTFPs. • Assist learners with open-mindedness in mixed ability groups to co-operatively discuss the uses of Non-Timber Forest Products (NTFP). **Digital Literacy learning:** Task learners to passionately with open-mindedness use search engines (YouTube) to surf for videos on the availability and sources of Non-Timber Forest Products (NTFP).	**Level 1 Recall** Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
Teaching and Learning Materials	• Hand samples /Flip chart of: i. Lesser-Known timber species (LKS) ii. Lesser Used timber species (LUS) • YouTube videos on i. Lesser-Known timber species (LKS) ii. Lesser-Used timber species (LUS) • Computer/Smart phone	

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
3.4.2.CS.1	3.4.2.LI.1	3.4.2.AS.1
Demonstrate knowledge and understanding of mass production, environmental impact and entrepreneurship of Timber Industry	**Basic Techniques in Mass production in Furniture Industry** **Critical Thinking and Talk for Learning Approaches:** Guide learners through whole class session to brainstorm the meaning of mass production with open-mindedness: **Group work/Collaborative Learning:** • Organise learners into mixed gender ability groups and assist them to co-operatively and open-mindedness, discuss advantages and disadvantages of mass production. • Assist learners with open-mindedness in mixed ability groups to co-operatively discuss the environmental impact of woodwork industry.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
	3.4.2.LI.2	3.4.2.AS.2
	Impact of wood work industry on the environment **Critical Thinking and Talk for Learning Approaches:** Guide learners through whole class session to brainstorm the meaning of environmental impact of woodwork industry with open-mindedness: **Group work/Collaborative Learning:** • Organise learners into mixed gender ability groups and assist them to co-operatively and open-mindedness, discuss the effect of woodwork industry waste on the environment. • Assist learners with open-mindedness in mixed ability groups to co-operatively discuss the possible ways to reduce the environmental impacts of timber products.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	3.4.2.LI.3	3.4.2.AS.3
	Basic entrepreneurship in woodwork industry **Critical Thinking and Talk for Learning Approaches:** Guide learners through whole class session to brainstorm the meaning of entrepreneurship with open-mindedness:	**Level 1 Recall** Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning**

	Group work/Collaborative Learning: • Organise learners into mixed gender ability groups and assist them to co-operatively and open-mindedness, discuss forms or types of business organizations. • Assist learners with open-mindedness in mixed ability groups to co-operatively discuss the business plan.	Level 4 Extended critical thinking and reasoning
Teaching and Learning Materials	• Hand samples /Flip chart of: iii. Lesser-Known timber species (LKS) iv. Lesser Used timber species (LUS) • YouTube videos on iii. Lesser-Known timber species (LKS) iv. Lesser-Used timber species (LUS) • Computer/Smart phone	

Subject APPLIED TECHNOLOGY
Strand 4. ELECTRICAL AND ELECTRONIC TECHNOLOGY
Sub-Strand 1. ELECTRICAL SYSTEMS DESIGN

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
2.4.1.LO.1		
Demonstrate knowledge and understanding of electrical Machines and appliances and apply the knowledge in servicing electrical appliances and circuits	**Collaboration and Communication** • Learners express their ideas during pair and group work, share ideas and respect one another in group and pair work as well as present both oral and written reports. • Oral and written group idea sharing Respecting and accepting group members' contributions • Sharing ideas and working together in pair and group activities. **Critical Thinking and Problem-Solving skills.** Being able to analyse, judge, and draw conclusions about the differences and similarities of the various methods in house wiring • Capability to imagine and plan a particular type of wiring required for a specific job. • Ability to assess a particular type of wiring in terms of its advantages and disadvantages and use it appropriately. • Capability to think critically and solve problems associated with house wiring. **Digital literacy skills:** • Can confidently prepare presentations using ICT and respecting other people's privacy. • Sharing information among team members using social media ethically. • Ability to search and share digital information. • Ability to type presentations and reports.	**GESI:** There is always a diverse group of learners in the classroom, each with unique needs and challenges. Therefore, it is essential to make sure that all teaching and learning approaches promote gender equality and social inclusion. learners learning electricals who have been introduced these techniques are more likely to: • Appreciate the choice of wiring system each person makes. • Appreciate the views of others when discussing electrical issues. • Value the views and contributions of others when taking decisions. **SEL:** Learners have been introduced to the educational strategies used to achieve social inclusion, social justice, and emotional regulation. Through SEL, learners are able to: • make a choice between the various types of wiring systems and available materials depending on the situation at hand. • be aware of his/her strength and weaknesses as far as the learning of electrical wiring is concern so as to seek for help where necessary.

	• Being able to research wiring methods, tools and materials using ICT tools such as the Google search engine and U-tube. **Leadership Skills and Personal Development** • Capable of expressing and explaining one's feelings in a group setting while working with others. • Taking on leadership roles in group projects • Demonstrate the ability to contribute to team discussions in order to reach an agreement on what action should be taken. • Exhibit the ability to assign tasks to different team members and recognize when their peers may require support or assistance. **Innovation and Creativity** • Performing tasks in novel ways that broaden learners' learning and decision-making on types of wiring circuits.	• relate to other learners when group assignment is given. • manage his /her time very well when given individual assignment. **National Core values:** For a country to advance, its people must build a set of values that will propel the country's development. Particularly with competent individuals, values like patriotism, honesty, accountability, and hard work are necessary to assure advancement and growth in industries. Therefore, learners are anticipated to: • exhibit sense of responsibility in the care and maintenance of tools and equipment in the electrical workshop. • be honest and sincere with clients when estimating and purchasing materials for their household wiring. • exhibit some sense of responsibility when working with tools in the workshop (in terms of theft)

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
2.4.1.CS.1	2.4.1.LI.1	2.4.1.AS.1
Apply knowledge and understanding of electrical Machines	**Describe the construction and principle of operation of AC motors.** **Focal Area:** AC Motors 1. Types of AC motors (induction, Synchronous) 2. Construction of each type (Stator, Rotor) 2. Operation of AC Motors 4. Application **Pedagogy:** **1. Talk for Learning** Through a whole class discussion, guide learners to discuss the meaning of motors **2. Research/ Collaborative Learning:** In mixed-ability groups, guide learners to undertake the following activities: • State the types of motors e.g. AC motors. • Describe the construction of AC motors and state the functions of the parts. • Outline the types of AC motors e.g. • Outline the applications of AC motors.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Critical thinking
	2.4.1.LI.2	2.4.1.AS.2
	Describe the construction and principle of operation of DC motors. **Focal Area:** DC Motors 1. Definition of DC motors 2. Types of DC motors (seris, shunt, compound) 3. Construction of DC motors 4. Operation 5. Application of each type **Pedagogy:** **Research/ Collaborative Learning:** In mixed-ability groups, guide learners to undertake the following activities: • Describe the construction of DC motors and state the functions of the parts.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Critical thinking

	• Outline the types of DC motors e.g. series, shunt and compound motors. • Outline the applications of DC motors.	
	2.4.1.LI.3	2.4.1.AS.3
	Describe the construction and principle of operation of AC Generators **Focal Area:** AC Generators 1. Types of AC Generators 2. Construction of each type 3. Operation of AC Generator 4. Application **Pedagogy:** **Research and Collaborative Learning** Organise the learners into mixed ability and gender inclusive groups, task them to research on the • Definition of generators • types of AC generators. • Description of the construction of AC generators and the functions of the parts. • types of AC generators e.g.Revolving field, Stationary field) • Outline the applications of AC generators.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Critical thinking
	2.4.1.LI.4	2.4.1.AS.4
	Describe the construction and principle of operation of DC generators. **Focal Area:** DC Generators 1. Types of AC Generators 2. Construction of each type 3. Operation of AC Generator 4. Application **Pedagogy:** **Research/ Collaborative Learning:** In mixed-ability groups, guide learners to undertake the following activities: • Describe the construction of DC **Generator** and state the functions of the parts. • Outline the types of DC **Generators** e.g. series, shunt and compound **Generator**.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Critical thinking

	• Outline the applications of each type DC **Generator**.	
	2.4.1.LI.5	2.4.1.AS.5
	Describe the construction and principle of operation of a transformer. **Focal Area:** Transformer • Laws of electromagnetic induction • The construction of a Transformer • Operation of the transformer **Pedagogy** **Collaborative/ talk for learning** **I**n mix-ability groups and with the use of the internet, task learners to undergo the following activities: • Describe a transformer. • Describe the construction of transformers. • Explain the Laws of electromagnetic induction and relate it to the operation of transformers.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Critical thinking
	2.4.1.LI.6	2.4.1.AS.6
	Explain losses that occur in a transformer and how they affect the performance of the transformer **Focal Area:** Losses and Efficiency Transformers 1. Losses in a transformer 2. Efficiency of transformer **Pedagogy** **Research/ Collaborative Learning:** In mixed-ability groups, guide learners to: • Explain the losses that occur in a transformer eg Core losses, Bearing friction loss, etc • Explain the effect of these losses on the transformer performance **Critical Thinking** In mixed-ability groups, guide learners to calculate for efficiency of transformer.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** **Level 4 Critical thinking**

	2.4.1.LI.7	2.4.1.AS.7
	Describe the methods of cooling transformers **Focal Area:** Methods Of Cooling Transformers • Air cooling • Oil cooling • Water cooling • Artificial Cooling **Pedagogy** **Collaborative/ talk for learning** **I**n mix-ability groups and with the use of the internet, task learners to: • Come out with reasons why transformers need cooling. • Describe the various methods of cooling transformers. • Indicate the type of transformers involved in each case.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Critical thinking
	2.4.1.LI.8	2.4.1.AS.8
	Calculate voltage regulation of transformers **Focal Area**: voltage regulation of transformers • Definition of Voltage Regulation • Importance of voltage regulation • Factors affecting voltage regulation • Calculating Voltage regulation • How to Improve Voltage regulation **Pedagogy:** **1. Research and Collaboration:** Organise the learners into mixed-ability and gender inclusive groups and task them to undertake the following practical activities: • Define Voltage regulation • Outline the importance of Voltage regulation • State the factors affecting Voltage regulation **2. Experiential Learning/collaborative Learning:** In pairs, task learners to calculate the voltage regulation of transformer.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**

	2.4.1.LI.9	2.4.1.AS.9
	Classify home appliances under resistive and inductive loads and outline faults associated with them **Focal Area:** classification of elelctrical appliances and common faults associated with them 1. Resistive Loads 2. Inductive Loads Common faults 1.Open-circuit fault 2. short-circuit fault 3. Ground fault 4. faulty accessories **Pedagogy:** **Talk for Learning/ Collaboration** Through a whole class discussion, guide learners to discuss: Examples of electrical appliances eg: Electric iron, cooker, heater, Blender, fan Group electrical appliances under resistive and inductive loads resistive loads e.g. heater, kettle, microwave, pressing iron etc, Inductive Loads e.g. blender, fans, drill machines, washing machines, etc. Come out with common faults associated with them	**Level 1 Recall** **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	2.4.1.LI.10	2.4.1.AS.10
	Demonstrate Knowledge and understanding of Appliance ServicingDescribe the process of servicing electrical appliances **Focal Area:** processes involved in appliance maintenance. 1. Types of Gadget/Circuit to be Diagnosed 2. Differences between faulty and functioning electrical Appliances 3. Outline steps in testing appliance for fault **Pedagogy:**	**Level 1 Recall** **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**

	Research and Collaboration: Organise the learners into mixed ability and gender inclusive groups and task them to undertake the following practical activities: 1. Identify the type of gadget/circuit to be diagnosed and describe its operation and function e.g., Iron, kettle and blender. 2. Distinguish between a faulty appliance/circuit and a functioning one teaching learners to be honest and sincere in their diagnosis. 3. Describe how to test each appliance/circuit to diagnose the fault. 4. Explain how to solve the problem. **NB:** Ensure all learners participate in all varieties of practical activities and project work given when practical wiring is being carried out, girls and the physically challenged should not be left out. If possible, some of them should be made group leaders learners who may be physically challenged should be given enough time to complete their project work.	
	2.4.1.LI.11	2.4.1.AS.11
	Describe the process of servicing electrical wiring circuits **Focal Area:** Processes involved in an electrical circuit. 1. Identification of types of Circuit eg lamp, socket outlet,or fan circuit 2. Identify nature of fault 3. Outline steps in testing the circuit **Pedagogy:** **Research and Collaboration:** Organise the learners into mixed ability and gender inclusive groups and task them to undertake the following practical activities: 1. Identify the type of /circuit to be diagnosed a 2. Identify nature of fault. 3. Outline steps in testing for the fault 4. Explain how to solve the problem. **NB:** Ensure all learners participate in all varieties of practical activities and project work given when practical wiring is being carried out, girls and the physically challenged should not be left out. If possible, some of them should be made group leaders learners who may be physically challenged should be given enough time to complete their project work.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	2.4.1.LI.12	2.4.1.AS.12
	Detect fault in electrical machines	Level 1 Recall

	Focal Area: Fault In Electrical Machines 1. Nature/ types of faults 2. Symptons of each fault Faults • Bearing faults (Noise, over heating) • Stator or Armature Fault (Motors may not start, Generators will produce no output) • Broken rotor bar and end ring faults (Noise and wobbling) • Open or shorted transformer windings (No output, over heating) **Pedagogy** **Research and Collaboration:** Organise the learners into mixed-ability and gender inclusive groups and task them to undertake the following practical activities: Outline major faults in electrical machines and associated symptoms. Describe diagnostic methods used to identify faults these faults.	**Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning

Subject APPLIED TECHNOLOGY
Strand 4. ELECTRICAL AND ELECTRONIC TECHNOLOGY
Sub-Strand 2. ELECTRONIC COMPONENTS AND CIRCUITS

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
2.4.2.LO.1		
Demonstrate knowledge and understanding of electronic components and use them to design and construct electronic circuits.	**Communication and Collaboration Skills** • Ability to express and share ideas during a whole class discussions and group works • Capable of speaking clearly in a group. **Critical Thinking and problem-solving skills** Being able to analyse, judge, and draw conclusions about the differences, similarities and application of the various types of electronic components. • Capability to imagine and plan a particular type of electronic component required for a specific job. • Capability to select a particular component to design a given electronic circuit. • Capability to think critically and solve problems associated with an electronic circuit. **Research and Computer Literacy Skills.** • The use of ICT tools such U- tube, to search for relevant information on the operation of transistors enhances the understanding of learners. • Ability to use ICT tools to surf the internet for information about transistors and their applications and present in class. • The ability of learners to design and simulate electronic circuits.	**GESI:** There are always a variety of learners in the classroom, each with their own requirements and difficulties. Therefore, it is crucial to make sure that all methods of teaching and learning encourage social inclusion and gender equality. Learners studying electronics who encounter these methods are more likely to: • Recognise and appreciate the output of each individual as they design electronic circuits to solve problems. • Be gender sensitive by exhibiting the designs of women as a way appreciating their efforts. • value and respect everyone's contribution to the design and construction of electronic circuits, especially those of the less privileged. **SEL:**Learners have been introduced to the educational strategies used to achieve social inclusion, social justice, and emotional regulation. Through SEL, learners are able to • have the determination to be able very good electronic circuit using electronic components. • be aware of his/her strength and weaknesses as far as the learning of the use

	Creativity and innovation: Ability to use new ideas to design and create new designs with electronic components.	transistors in designing circuits is concern in order to seek for help where necessary. • relate to other learners when group assignment is given. • manage his /her time very well when given individual assignment. **National Core values:** In order for a country to advance, its people must build a set of values that will propel the country's development. Particularly with competent individuals, values like patriotism, honesty, accountability, and hard work are necessary to assure advancement and growth in industries. Therefore, learners are anticipated to: • be taught to appreciate hard work, independence and determination when asked to do any piece of work • exhibit sense of responsibility in the care and maintenance of tools and equipment in the electrical workshop. • be honest and sincere when purchasing electronic components.

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
2.5.2.CS.1	2.5.2.LI.1	2.5.2.AS.1
Demonstrate knowledge and understanding of electronic components and use them to design and construct electronic circuits.	**Describe the features and principles of operation of Integrated Circuits** **Focal Area:** Integrated Circuits 1. Identifying Pin connection of Timers 555, 556, 2. Principles of operation of the various Timer ICs **Pedagogy** **Research and Collaboration:** Organise the learners into mixed-ability and gender groups and task them to research on Google search engine and the U-Tube to undertake the following activities and do group presentation on their findings: 1. Identify the pin connections of the 555 and 556 timer IC and state typical voltage supply for the IC 2. Explain the principle of operation of each and how each can be connected in a circuit **Independent learning:** Task learners to draw the block diagrams of 555, 556 timers and indicate the pin connections of each of them encourage them to really do independent work and be hard working as well.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	2.5.2.LI.2	2.5.2.AS.2
	Apply the principle of operation of Timers in designing circuits **Focal Area:** Designing with Integrated Circuit Principles of Operations of Integrated Circuits(Timers 555, 556 Designing circuits with Timers **Pedagogy** **Collaborative Learning:** Work in pairs to; Explain how each IC can be connected in a circuit for a typical function e.g. timer, **Independent project work:** Task learners individually to Design and construct multi-vibrators and encourage them to really do independent work as well as exhibiting a sense of responsibility when working with tools in the workshop (in terms theft).	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning

	Project based learning and collaboration: Engage learners in mixed gender groupings to: Design and simulate multi-vibrators (monostable, bi-stable and a stable) with 555 and 556 timer IC using Multisim **NB:** Ensure all learners participate in all varieties of practical activities and project work given and also when practical wiring is being carried out, girls and the physically challenged should not be left out. If possible, some of them should be made group leaders. Learners who may be physically challenged should be given enough time to complete the project work.	
	2.5.2.LI.3	2.5.2.AS.3
	Describe the features and principles of operation of Operational Amplifiers **Focal Area: Integrated Circuits** 1. Identifying Pin connection of Op-amps 741 and 4558 2. Principles of operation of the various op-amps **Pedagogy** **Research and Collaboration:** Organise the learners into mixed-ability and gender groups and task them to research on Google search engine and the U-Tube to undertake the following activities and do group presentation on their findings: 1. Identify the pin connections of the 741 and 4558 and state typical voltage supply for the IC 2. Explain the principle of operation of each and how each can be connected in a circuit **Independent learning:** Task learners to draw the block diagrams of 741 and 4558 and indicate the pin connections of each of them. Encourage them to really do independent work and be hard-working as well.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	2.5.2.LI.4	2.5.2.AS.4
	Apply the principle of operation of op-amps in designing circuits **Focal Area:** Designing with OP-AMPS 1. Principles of Operations of operational amplifiers 741, 4558 2. Designing circuits with Integrated Circuits	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning**

	Pedagogy **Collaborative Learning:** Work in pairs to; Explain how each IC can be connected in a circuit for a typical function e.g. comparator, Inverting amplifiers **Independent project work:** Task learners individually to Design and construct inverting and non-inverting amps and encourage them to really do independent work as well as exhibiting a sense of responsibility when working with tools in the workshop (in terms theft). **Project-based learning and collaboration:** Engage learners in mixed-gender groupings to: Design and simulate comparators, inverting and non-inverting amplifiers, and summing amplifiers with 741 and 4558 op-amps. using Multisim **NB:** Ensure all learners participate in all varieties of practical activities and project work given and also when practical wiring is being carried out, girls and the physically challenged should not be left out. If possible, some of them should be made group leaders. Learners who may be physically challenged should be given enough time to complete the project work	Level 4 Extended critical thinking and reasoning
	2.5.2.LI.5	2.5.2.AS.5
	Describe types of logic gates **Focal Are**a: Types of Logic Gates 1.Types-AND, NAND, OR, NOR, NOT) 2.Logic Gates symbols 3. Truth tables of each **Pedagogy** **Collaborative Learning:** With the use of the internet, engage learners in mixed ability groups to undergo the following activities: • Define the term 'Logic Gate ' • Outline the types of Logic gates that we have and give examples i. e. Basic logic gate e.g. AND, NOT and OR gates and Universal Logic Gates e.g. NAND and NOR gates.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**

	Experiential Learning/collaborative learning: In mixed-ability groups and with the use of the internet, task learners to: • describe how each gate operate and outline their applications as well. **Experiential Learning:** Engage learners to work in mixed gender groups to: • Construct the truth table for the various logic gates and determine the output functions of the various gates from the Boolean expressions given. • Task learners to present their findings from the group work **Experiential Learning/collaborative learning/ project-based learning:** Group learners to in mixed-ability and guide them to perform experiments on logic gates functions E.g. F = (A.$\overline{B}$ +$\overline{A}$ .B) **NB.** Ensure all learners participate in all varieties of practical activities and project work given mixed gender groupings as well and also ensure mixed gender grouping when practical work such as constructing amplifier circuits is being carried out.	
	2.5.2.LI.6	2.5.2.AS.6
	Solve problems on Boolean Algebra **Focal Are**a: 1. Elements of Boolean algebra 2. Operations or functions of Boolean algebra 3. Basic rules for each of the operations of Boolean algebra 4. Basic Axioms **Pedagogy** **Collaborative Learning:** Engage learners in mixed ability groups to undergo the following activities: • Come out with rules of Boolean Algebra • Come out with the basic axioms • Discuss element of Boolean Algebra	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning

	Experiential Learning/collaborative learning: In mixed-ability groups and with the use of the internet, task learners to: • Solve operations on Boolean Algebra **NB.** Ensure all learners participate in all varieties of practical activities and project work given mixed gender groupings as well and also ensure mixed gender grouping when practical work such as constructing.	
	2.5.2.LI.7	2.5.2.AS.7
	Describe the truth table for the various logic gates and determine the output function of the various gates. **Focal Are**a: 1. Truth Tables of logic gates 2. Boolean Expression. **Pedagogy** **Experiential Learning:** Engage learners to work in mixed gender groups to: • Construct the truth table for the various logic gates and determine the output functions of the various gates from the Boolean expressions given. • Task learners to present their findings from the group work **Experiential Learning/collaborative learning/ project-based learning:** Group learners in mixed-ability and guide them to perform experiments on logic gates functions E.g. F = (A.$\overline{B}$ +$\overline{A}$ .B) **NB.** Ensure all learners participate in all varieties of practical activities and project work given mixed gender groupings as well and also ensure mixed gender grouping when practical work such as constructing amplifier circuits is being carried out.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	2.5.2.LI.8	2.5.2.AS.8
	Manipulate and simplify Boolean Algebra **Focal Are**a: 1. Redundancy theorem	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning**

	2. Race-Hazard theorem 3. De-Morgans Theorem **Pedagogy** **Collaborative Learning:** Engage learners in mixed-ability groups to undergo the following activities: • Explain redundancy theorem • Explain Race-Hazard theorem • Explain De-Morgans Theorem **Experiential Learning/collaborative learning:** In mixed-ability groups and with the use of the internet, task learners to: • Solve operations on Redundancy theorem • Solve operations using Race-Hazard theorem • Solve problems on De-Morgans Theorem **NB.** Ensure all learners participate in all varieties of practical activities and project work given mixed gender groupings as well and also ensure mixed gender grouping when practical work such as constructing.	Level 4 Extended critical thinking and reasoning
	2.5.2.LI.9	2.5.2.AS.9
	Apply principles of logic gates in designing electronic circuits. **Focal Area:** 1.Obtaining logic expressions from circuits 2.Designing circuits with gates **B. Pedagogy** **Collaborative Learning:** With the use of the internet, engage learners in mixed ability groups to undergo the following activities: ' • Outline the types of Logic gates that we have and give examples i. e. Basic logic gate e.g. AND, NOT and OR gates and Universal Logic Gates e.g. NAND and NOR gates.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**

	Experiential Learning/collaborative learning: In mixed-ability groups and with the use of the internet, task learners to: • describe how each gate operate and outline their applications as well. **3. Experiential Learning:** Engage learners to work in mixed gender groups to: • Construct the truth table for the various logic gates and determine the output functions of the various gates from the Boolean expressions given. • Draw circuits with logic gates and obtain their logic expressions • Design flip-flops using logic gates • Task learners to present their findings from the group work **NB.** Ensure all learners participate in all varieties of practical activities and project work given mixed gender groupings as well and also ensure mixed gender grouping when practical work such as constructing amplifier circuits is being carried out.	
	2.5.2.LI.10	2.5.2.AS.10
	Describe the various type of modulation in communication **Focal Areas:** 1. Carrier Wave, 2. Modulation, 3. Types of Modulation (e.g. Frequency Modulation, Amplitude modulation, Pulse width Modulation) **Pedagogy** **Collaborative Learning:** With the use of the internet, engage learners in mixed-ability groups to undergo the following activities: • Explain Carrier wave • Explain modulation • Outline the types of modulation e.g.: AM, FM **Research and Collaboration:** Organise the learners into mixed-ability and gender groups and task them to research on the Google search engine and the U-Tube to undertake the following activities and do a group presentation on their findings:	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning

	• Amplitude Modulation • Frequency modulation Explain the differences between Amplitude Modulation and Frequency Modulation.	
	2.5.2.LI.11	2.5.2.AS.11
	Describe AM and FM transmitters in electronic communication **Focal Areas:** • AM Transmitter • FM transmitter Pedagogy **Collaborative Learning:** With the use of the internet, engage learners in mixed ability groups to explain the following : • AM Transmitter • FM transmitter **Research and Collaboration:** Organise the learners into mixed-ability and gender groups and task them to research on Google search engine and the U-Tube to undertake the following activities and do group presentation on their findings: Draw the block diagram of • AM Transmitter • FM transmit Explain the differences between the AM Transmitter and the FM	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	2.5.2.LI.12	2.5.2.AS.12
	Describe AM and FM receivers in electronic communication **Focal Areas:** • AM Receiver • FM Receiver **Pedagogy** **Collaborative Learning:** With the use of the internet, engage learners in mixed-ability groups to explain the following:	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**

	• AM Receiver • FM Receiver **Research and Collaboration:** Organise the learners into mixed-ability and gender groups and task them to research on the Google search engine and the U-Tube to undertake the following activities and do a group presentation on their findings: Draw the block diagram of • AM Receiver • FM Receiver Explain the differences between the AM and FM Receivers.	
Teaching and Learning Materials	• Computers installed with multism software • Electronic Components	• multimeters • the use of the internet