SENIOR SCHOOL CURRICULUM DESIGN

GRADE 10

ELECTRICAL TECHNOLGY

KENYA INSTITUTE OF CURRICULUM DEVELOPMENT
2024

KENYA INSTITUTE OF CURRICULUM DEVELOPMENT

Nurturing Every Learner's Potential

SENIOR SECONDARY SCHOOL CURRICULUM DESIGN

GRADE 10

ELECTRICAL TECHNOLOGY

JUNE, 2024

First Published in 2024

ISBN: 978-9914-52-900-5

Published and printed by Kenya Institute of Curriculum Development

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NATIONAL GOALS OF EDUCATION

Education in Kenya should:

1. **Foster nationalism and patriotism and promote national unity.**
   Kenya's people belong to different communities, races and religions, but these differences need not divide them. They must be able to live and interact as Kenyans. It is a paramount duty of education to help young people acquire this sense of nationhood by removing conflicts and promoting positive attitudes of mutual respect which enable them to live together in harmony and foster patriotism in order to make a positive contribution to the life of the nation.

2. **Promote the social, economic, technological and industrial needs for national development.**
   Education should prepare the youth of the country to play an effective and productive role in the life of the nation.
   a) **Social Needs**
      Education in Kenya must prepare children for changes in attitudes and relationships which are necessary for the smooth progress of a rapidly developing modern economy. There is bound to be a silent social revolution following in the wake of rapid modernization. Education should assist our youth to adapt to this change.
   b) **Economic Needs**
      Education in Kenya should produce citizens with the skills, knowledge, expertise and personal qualities that are required to support a growing economy. Kenya is building up a modern and independent economy which is in need of an adequate and relevant domestic workforce.
   c) **Technological and Industrial Needs**
      Education in Kenya should provide learners with the necessary skills and attitudes for industrial development. Kenya recognizes the rapid industrial and technological changes taking place, especially in the developed world. We can only be part of this development if our education system is deliberately focused on the knowledge, skills and attitudes that will prepare our young people for these changing global trends.

3. **Promote individual development and self-fulfilment**
   Education should provide opportunities for the fullest development of individual talents and personality. It should help children to develop their potential interests and abilities. A vital aspect of individual development is the building of character.

4. **Promote sound moral and religious values.**
   Education should provide for the development of knowledge, skills and attitudes that will enhance the acquisition of sound moral values and help children to grow up into self-disciplined, self-reliant and integrated citizens.

5. **Promote social equity and responsibility.**
   Education should promote social equality and foster a sense of social responsibility within an education system which provides equal educational opportunities for all. It should give all children varied and challenging opportunities for collective activities and corporate social service irrespective of gender, ability or geographical environment.

6. **Promote respect for and development of Kenya's rich and varied cultures.**
   Education should instill in the youth of Kenya an understanding of past and present cultures and their valid place in contemporary society. Children should be able to blend the best of traditional values with the changing requirements that must follow rapid development in order to build a stable and modern society.

7. **Promote international consciousness and foster positive attitudes towards other nations.**
   Kenya is part of the international community. It is part of the complicated and interdependent network of peoples and nations. Education should therefore lead the youth of the country to accept membership of this international community with all the obligations and responsibilities, rights and benefits that this membership entails.

8. **Promote positive attitudes towards good health and environmental protection.**
   Education should inculcate in young people the value of good health in order for them to avoid indulging in activities that will lead to physical or mental ill health. It should foster positive attitudes towards environmental development and conservation. It should lead the youth of Kenya to appreciate the need for a healthy environment.

LEARNING OUTCOMES FOR SENIOR SCHOOL

By the end of senior school, the learner should be able to:

1. Communicate effectively and utilise information and communication technology across varied contexts.
2. Apply mathematical, logical and critical thinking skills for problem solving.
3. Apply basic research and scientific skills to manipulate the environment and solve problems.
4. Exploit individual talents for leisure, self-fulfilment, career growth, further education and training.
5. Uphold national, moral and religious values and apply them in day to day life.
6. Apply and promote health care strategies in day to day life.
7. Protect, preserve and improve the environment for sustainability.
8. Demonstrate active local and global citizenship for harmonious co-existence.
9. Demonstrate appreciation of diversity in people and cultures.
10. Manage pertinent and contemporary issues responsibly.

THE SENIOR SCHOOL IN THE COMPETENCY BASED CURRICULUM (CBC)

Senior School is the forth level of Basic Education in the Competency Based Curriculum (CBC) that learners shall come to after the Pre-Primary, Primary and Junior School (JS). The essence of Senior School is to offer learners a Pre- University/ Pre- career experience where the learners have an opportunity to choose pathways where they have demonstrated interest and/or potential at the earlier levels. Senior school comprises three years of education for learners in the age bracket of **15 to 18 years** and lays the foundation for further education and training at the tertiary level and the world of work. In the CBC vision, learners exiting this level are expected to be ***engaged, empowered and ethical citizens*** ready to participate in the socio-economic development of the nation.

At this level, learners shall take **SEVEN (07) learning areas (LAs)** as recommended by the *Presidential Working Party on Educational Reforms* (PWPER). These shall comprise **Four Compulsory** learning areas, and Three learning areas opted for by the learner according to their choses Pathway. While English and Kiswahili are indicated as Compulsory, the learners who opt for these learning areas as their subjects of specialization shall go through a *differentiated curriculum* in terms of scope, experiences and assessment. Such learners shall; therefore, take *Advanced English* or *Kiswahili Kipevu* with additional two lessons. It is recommended that AT LEAST TWO learning areas should be from chosen Pathway. In exceptional cases, some learners may opt for ONE learning area from the chosen Pathway and a maximum of TWO learning areas from any of the three pathways; depending on the learner's career projections and with guidance by the principals at Senior School.

PROPOSED LIST OF SUBJECTS AT SENIOR SCHOOL

Compulsory Subjects	**Science, Technology, Engineering & Mathematics (STEM)**	**Social Sciences**	**Arts & Sports Science**
1. English 2. Kiswahili/KSL 3. Community Service Learning 4. Physical Education ***NB: ICT skills will be offered to all students to facilitate learning and enjoyment***	5. Mathematics/Advanced Mathematics 6. Biology 7. Chemistry 8. Physics 9. General Science 10. Agriculture 11. Computer Studies 12. Home Science 13. Drawing and Design 14. Aviation Technology 15. Building and Construction 16. Electrical Technology 17. Metal Technology 18. Power Mechanics 19. Wood Technology 20. Media Technology* 21. Marine and Fisheries Technology*	22. Advanced English 23. Literature in English 24. Indigenous Language 25. Kiswahili Kipevu/Kenya Sign Language 26. Fasihi ya Kiswahili 27. Sign Language 28. Arabic 29. French 30. German 31. Mandarin Chinese 32. History and Citizenship 33. Geography 34. Christian Religious Education/ Islamic Religious Education/Hindu Religious Education 35. Business Studies	36. Sports and Recreation 37. *Physical Education (C)* 38. Music and Dance 39. Theatre and Film 40. Fine Arts

LESSON DISTRIBUTION AT SENIOR SCHOOL

The number of lessons in each of the compulsory learning areas shall be 4; while the optional areas shall be 6 lessons each. A lesson shall be 40 minutes. The "free" lessons shall be used for development of ICT skills, Pastoral Instruction Programme (PPI), projects, collaborative study and further reading.

ESSENCE STATEMENT

Electricity is an essential form of energy in the modern world. People use electricity for lighting, heating, air conditioning, refrigeration and for powering appliances like computers, electronics, and transportation systems. The continuing connectivity of electricity across Kenya and beyond requires sustained technical labour supply. This justifies the need to offer Electrical Technology as a subject in Senior Secondary Schools to help orient learners towards the development of a skilled workforce in electrical technology.

Electrical technology forms part of the STEM education and training discipline. STEM has been prioritised in the Kenya Vision 2030 as well as Sessional Paper No. 1 of 2019 as being pivotal in the development of Science, Technology and Innovation for human capital development. Electrical technology as a subject at Senior Secondary School builds on the competencies developed in Pre-Technical studies and Integrated Science at Junior School. It equips the learner with competencies of analysis, installation and maintenance of electrical and electronic equipment.

It is envisaged that this subject will provide an opportunity to gain knowledge, practical skills, attitudes and values that will enable the learner to use electricity and electrical appliances competently. It will also prepare the learner to either pursue further training in middle level colleges and universities in such courses as electrical engineering, mechatronics, telecommunication, communication electronics, industrial electronics, power engineering or join the world of work as an electrical wireman or fitter.

SUBJECT GENERAL LEARNING OUTCOMES

By the end of Senior School, the learner should be able to:

1. Observe personal safety, safety of tools, equipment and machines in the practice of electrical engineering works.
2. Analyse, design, and construct electric circuits.
3. Troubleshoot and fix faults in electrical and electronic systems.
4. Apply appropriate communication skills across varied settings and audiences in interpretation of Electrical Engineering works.
5. Practise good citizenship in waste management and ethical use of electronic and electrical technology.
6. Adhere to the established standards and regulations in Electrical Technology to uphold professional and ethical practices.
7. Utilise acquired skills, knowledge and attitude for career growth and further education and training in electrical engineering.
8. Appreciate electrical technology in the socio-economic development of the country.

SUMMARY OF STRANDS AND SUB STRANDS

Strand	Sub Strands	Suggested Number of Lessons
1. Fundamentals of Electrical Technology	1.10.1 Introduction to Electrical Technology	10
	1.10.2 D.C Electric Circuit	18
	1.10.3 Capacitors and Capacitance	8
	1.10.4 Cells and Batteries	10
2. Electrical Machines	2.10.1 Magnetism	14
	2.10.2 Electromagnetism	15
	2.10.3 Measuring Instruments	14
3. Electrical Installation.	3.10.1 Generation, Transmission and Distribution of Electricity	14
	3.10.2 Equipment at the Intake Point	12
	3.10.3 Final Circuits	18
4. Electronics	4.10.1 Semiconductor Theory	15
	4.10.2 Semiconductor Diodes	16
	4.10.3 Transistors	16
Total Number of Lessons		**180**

Note: The suggested number of lessons per sub strand may be more or less depending on the context

STRAND 1.0 FUNDAMENTALS OF ELECTRICAL TECHNOLOGY

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question(s)
1.0 **Fundamentals of Electrical Technology**	**1.0 Introduction to Electrical Technology** **(10 lessons)**	By the end of the sub strand, the learner should be able to: a) explain the importance of electrical technology in society, b) identify career opportunities in the electrical technology field, c) apply safety regulations while carrying out electrical tasks, d) explain the roles of stakeholders in application of electrical safety, e) embrace electrical technology as a career in society.	The learner is guided to; ● discuss the importance of electrical technology in society; use digital or print media to search for information on the uses of electricity in day to day life, ● brainstorm with peers and present the job/career opportunities available in the electrical technology field, ● use digital or print resources to search for information on safety rules and regulations in an electrical technology workplace, role play on safety regulations while carrying out tasks *(personal protective equipment, storage of tools, cleanliness of tools),*	1. Why is the study of electrical technology important in society? 2. How is electricity utilised in various applications?

			● discuss with peers the roles of workers, employers and government agencies in application of electrical safety in the workplace, ● brainstorm with peers and make presentations on the career opportunities in electrical technology field, Engage with a resources person as he/she explains the career opportunities in electrical technology field, Visit a local electrical technology workplace for career opportunities in electrical technology.	

Core Competencies to be developed:

- Communication and collaboration: learner develops speaking and listening skills when engaging with a resource person explaining the career opportunities in the electrical technology field
- Digital literacy: learner interacts with and manipulates digital devices to search for information on the fundamental concepts of electrical technology
- Self-efficacy: effective communication skills are developed as the learner discusses the roles of workers, employers and government agencies in application of electrical safety in the workplace

Values:

- Respect: learner appreciates diverse opinions as they discuss on the job/career opportunities available in the electrical technology field,
- Love: learner cares for others to avoid injury as they role play on safety regulations while carrying out electrical tasks.

Pertinent and Contemporary Issues (PCIs):

Disaster risk reduction and management : learner acquires skills to mitigate risks related to safety when role playing on safety regulations while carrying out electrical tasks

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question(s)
1.0 Fundamentals of Electrical Technology	**1.2 D.C Circuits** **(16 lessons)**	By the end of the sub strand, the learner should be able to: a) describe the properties of resistors in DC circuits, b) analyse DC circuit using circuit laws, c) construct resistor networks in DC circuits, d) troubleshoot DC circuits in electrical appliances, e) appreciate the practical application of DC circuits in day to day life.	The learner is guided to; ● use digital and print media to search for information on the properties of resistors, ● perform an experiments on resistive circuits to determine the relationships between voltage and current in a circuit using Ohm' law and Kirchhoff's laws, ● use electrical components to construct series and parallel resistor networks in DC circuits, ● use measuring and test instruments to trace faults in DC circuits (*open circuit, short circuit, faulty components, dry joints, loose terminals),* ● brainstorm with peers and make presentations on the different practical applications of DC circuits in day to day	1. How do DC electric circuits work? 2. What are the applications of DC circuits in day to day life?

			life. (Home automation and car safety applications)	

Core competencies to be developed:

- Creativity and imagination: learner chooses electrical components to construct series and parallel resistor networks in DC circuits.
- Learning to learn: learner searches for information on the properties of resistors.
- Critical thinking: learner use measuring and test instruments to trace faults in DC circuits.

Values:

- Respect: learners appreciate diverse opinions as they brainstorm with peers on the different practical applications of DC circuits in day to day life.
- Unity: learners develop positive relationships as they interact and share responsibilities while performing experiments in groups.
- Responsibility: learners care for materials and equipment as they perform experiments.

Pertinent and Contemporary Issues (PCIs):

- Safety and Security: Learners observe safety as they perform experiments in groups to determine electrical quantities
- Self-esteem: Learners develop confidence as they make presentations on the different practical applications of DC circuits in day to day life
- Disaster Risk Reduction: as learners brainstorm with peers and make presentations on the different practical applications of DC circuits in safe road use applications.

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question(s)
1.0 Fundamentals of Electrical Technology	**1.3 Capacitors and Capacitance** **(8 lessons)**	By the end of the sub strand, the learner should be able to: a) describe the principle of operation of a capacitor in an electric circuit, b) explain the characteristics of capacitive circuits, c) select appropriate capacitors for use in a given application in electric circuits, d) analyse series and parallel connection of capacitors in electric circuits, e) appreciate the importance of capacitors in electrical appliances.	The learner is guided to; ● use digital and print media to search for information on the principle of operation of a capacitor, ● carry out an experiment using a capacitor and resistor setup to verify the characteristic of capacitors*(voltage-time and current-time),* ● use datasheets to choose suitable capacitors to construct resistor-capacitor circuits, ● perform calculations to determine total capacitance in series and parallel capacitor circuits, ● brainstorm with peers and make presentations on the importance of capacitors in electrical appliances(Charge storage in motor control and	1. How do capacitors work? 2. Why are capacitor important in electrical technology?

			Timer circuits in operation of traffic lights)	

Core Competencies to be developed:

- Critical thinking and problem solving: as the learner interprets and makes inference when performing experiments to verify the characteristic of capacitors
- Communication and collaboration: as the learner speaks influentially while brainstorming with peers and making presentations on the importance of capacitors in electrical appliances.
- Digital literacy: as the learner access learning material while using digital and print media to search for information on the principle of operation of a capacitor.

Values:

- Respect: as the learner exercises patience as they select appropriate capacitors for a given application in electric circuits.
- Responsibility: as the learner takes care of tools and measurement instruments while performing experiments in groups to verify the relationship between voltage and current in capacitive circuits.

Pertinent and Contemporary Issues (PCIs):

- Analytical thinking: as the learner perform calculations to determine capacitance connected in series and parallel in electric circuits
- Socio-economic and environmental issues: learners exercise safety in the laboratory while performing experiments in groups to verify the relationship between voltage and current in capacitive circuits.

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question(s)
1.0 Fundamentals of Electrical Technology	**1.4 Cells and Batteries** **(10 lessons)**	By the end of the sub strand, the learner should be able to: a) describe the principle of operation of a simple cell, b) connect series and parallel battery arrays in a circuit, c) conduct battery charging procedure for a secondary battery, d) perform maintenance procedures for cells and batteries for appliances, e) appreciate the importance of safe disposal of cells and batteries.	The learner is guided to; a) use digital and print media to search for information on operation of a simple cell, *b)* perform experiments to measure total voltage of battery arrays *(series and parallel connections),* c) carry out tasks on battery charging procedure for a secondary battery, d) carry out maintenance on cells and batteries (*terminals cleaning, water level maintenance, proper storage, prevention against overcharging and undercharging*) e) safely handle hazardous materials used in batteries.	1. How do cells and batteries work? 2. How are different types of batteries applied in various fields?
Core Competencies to be developed ● Critical thinking and problem solving: learner makes critical observation while carrying out maintenance on cells and batteries ● Citizenship: leaner contributes to a better world through safe handling hazardous materials used in batteries				

Values: Responsibility: learner demonstrate care of materials and equipment while performing maintenance tasks on cells and batteries.
Pertinent and Contemporary Issues (PCIs): Safety and security: learner observes safety by exercising proper handling of hazardous materials used in batteries

Suggested Assessment Rubric

Indicator	**Exceeds expectation**	**Meets expectation**	**Approaches expectation**	**Below expectation**
Ability to describe the properties of components used in DC circuits.	Describes the properties of components used in DC circuits with examples	Describes the properties of components used in DC circuits.	Partly describes the properties of components used in DC circuits.	Describes the properties of components used in DC circuits with assistance
Ability to apply circuit laws to evaluate electrical quantities in a DC circuit.	Precisely applies circuit laws to evaluate electrical quantities in a DC circuit.	Applies circuit laws to evaluate electrical quantities in a DC circuit.	Partially applies circuit laws to evaluate electrical quantities in a DC circuit.	Applies circuit laws to evaluate electrical quantities in a DC circuit with assistance
Ability to Construct DC circuits in a workplace	Correctly constructs DC circuits in a workplace	Constructs DC circuits in a workplace	Partly constructs DC circuits in a workplace	Constructs DC circuits in a workplace with assistance
Ability to analyse DC electric circuits in a workplace	Analyse DC electric circuits in a workplace in detail	Analyses DC electric circuits in a workplace	Partly analyses DC electric circuits in a workplace	Analyses DC electric circuits in a workplace with assistance

STRAND 2.0 ELECTRICAL MACHINES

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question(s)
2.0 Electrical Machines	**2.1 Magnetism** (14 lessons)	By the end of the sub strand, the learner should be able to: a) explain the magnetic properties of materials, b) perform magnetization and demagnetization procedures of magnetic materials, c) draw magnetic field patterns around a magnet, d) care for magnets used in equipment at a workplace, e) appreciate application of magnets in day-to-day life.	The learner is guided to; ● use digital or print media to search for information on magnetic properties of materials, ● carry out experiments on magnetization and demagnetization of magnetic materials, ● conduct experiments to verify magnetic field patterns around bar, U-shape, ring or disc shaped magnet - *(using iron filling, compass, magnetometer, ferrofluids),* ● appropriately store magnets in the workplace *(using magnetic keepers, storing in N-S direction).* ● brainstorm with peers and make presentations on the	1. What causes magnetism? 2. Why are magnets made in different shapes?

			application of magnets in day-today life.	

Core Competencies to be developed

- Digital literacy: learner develops digital skills when interacting and manipulating digital devices to search for information on magnetic properties of materials
- Self-efficacy: learner acquires effective communication skills when presenting findings on the application of magnets in day-today life.

Values:

- Responsibility: learner exercises accountability in applying appropriate methods of storing magnets in the workplace.
- Unity: learner cooperates with others when conducting experiments to verify magnetic field lines around a magnet.

Pertinent and Contemporary Issues (PCIs):

Personal safety and security: learner demonstrates basic safety habits as they safely carry out experiments in group on magnetization and demagnetization of magnetic materials.

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question(s)
2.0 Electrical Machines	**2.2 Electro-magnetism** (15 lessons)	By the end of the sub strand, the learner should be able to: a) explain the principle of electromagnetism in electrical technology, b) establish the magnetic field pattern of a current carrying conductor, c) construct a solenoid for a given application, d) construct an electromagnetic device for a given application, e) troubleshoot electromagnetic circuit in an appliance, f) appreciate the importance of electromagnetism in electrical devices and machines	The learner is guided to; ● use digital or print media to search for information on principle of electromagnetism in electrical technology, ● demonstrate the magnetic field pattern of a current carrying conductor (straight wire and coil) using screw rule, right-hand grip rule) ● using locally available materials to construct and test solenoid of varying parameters (*coil turns, current, core material and coil length*) ● using locally available materials to construct electromagnetic device for different applications *(electric bell, relay, magnetic pick up*), ● Use measuring and testing equipment to trace faults in electromagnetic circuits (open	1. How are electromagnets made? 2. Why is it preferable to use an electromagnet and not a permanent magnet?

			circuit, short circuit, loose connections) ● Brainstorm with peers on the importance and application of electromagnetism in real life.	

Core competencies to be developed

- Digital literacy: as learner uses digital devices to search for information on principle of electromagnetism in electrical technology
- Learning to learn: as learner explores with peers to establish the magnetic field pattern of a current carrying conductor,
- Creativity and imagination: as learner constructs and tests a solenoid using locally available materials

Values:

- Responsibility: learner care for digital devices as he/she searches for information on principle of electromagnetism in electrical technology
- Respect: learner embraces others opinion as they discuss with peers the operation of electromagnetic devices and machines
- Unity: learner collaborate with peers as they construct and test solenoid using locally available materials

Pertinent and Contemporary Issues (PCIs):

- Safety: learner observes online safety as they use internet responsibly to search for information on principle of electromagnetism in electrical technology
- Self-awareness: learner discovers his/her ability as they construct and test solenoid using locally available materials
- Environment and Technology: learner reuses locally available materials to construct solenoid

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question(s)
2.0 Electrical Machines	**2.3 Measuring Instruments** (14 lessons)	By the end of the sub strand, the learner should be able to: a) explain the principle of operation of coil-based measuring instruments, b) compute resistance values for 'shunts and multipliers' of coil-based measuring instruments, c) calibrate coil based measuring instruments to ensure accuracy of measured quantities, d) select a suitable scale for measuring a specified electrical quantity, e) recognise the importance of electrical measuring instruments.	The learner is guided to; ● use digital and print media to search for information on the principle of operation of coil-based measuring instruments, perform calculations for extending range to convert coil-based instruments to measure voltage or current, ● Perform calibration tasks on measuring instruments *(zero calibration, fine-tuning, range calibration),* ● carry out measurement of electrical quantities using calibrated measuring instruments, ● brainstorm with peers on the importance of coil based instruments in day to day life and make presentation.	1. How does a measuring instrument work? 2. How are measuring instruments calibrated?
Core Competencies to be developed: ● Digital literacy: learner interact with digital devices while searching for information on the principle of operation of coil-based measuring instruments.				

● Communication and collaboration: learner contributes to groups decision making while conducting hands-on activity to verify the principles of operation of coil-based measuring instruments ● Learning to learn: learner seeks information on application of coil based instruments.
Values: ● Responsibility: as the learner calibrates measuring instruments to ensure accuracy of measured quantities ● Respect: as the learner understands and appreciates others opinion as they brainstorm with peers on the importance of coil based instruments
Pertinent and Contemporary Issues (PCIs): ● Safety and Security: as the learner exercises safety in the laboratories while carrying out measurement of electrical quantities using calibrated measuring instruments ● Social skills: as the learner interact with peers while brainstorming on the importance of coil based instruments

Suggested Assessment Rubric

Indicator	Exceeds expectation	Meets expectation	Approaches expectation	Below expectation
Ability to explain the principle of operation of coil-based measuring instruments.	Precisely explains the principle of operation of coil-based measuring instruments	Explains the principle of operation of coil-based measuring instruments	Partially describes the principle of operation of coil-based measuring instruments	Hardly describes the principle of operation of coil-based measuring instruments
Ability to modify coil based measuring instruments to measure current and voltage	Comprehensively applies safety rules and regulations while handling electrical tools, machines and	Applies safety rules and regulations while handling electrical tools, machines and equipment in a workplace	Sometimes applies safety rules and regulations while handling electrical tools, machines and	Rarely applies safety rules and regulations while handling electrical tools, machines and equipment in a

Indicator	Exceeds expectation	Meets expectation	Approaches expectation	Below expectation
	equipment in a workplace		equipment in a workplace	workplace with assistance
Ability to calibrate coil based measuring instruments for accurate measurement.	Appropriately calibrates coil-based measuring instruments for accurate measurement.	Calibrates coil-based measuring instruments for accurate measurement.	Calibrates some coil-based measuring instruments for accurate measurement.	Hardly calibrates coil-based measuring instruments for accurate measurement.
Ability to compute quantities in coil-based measuring instruments	Appropriately computes quantities in coil-based measuring instruments	Computes quantities in coil-based measuring instruments	Computes some quantities in coil-based measuring instruments	Hardly computes quantities in coil-based measuring instruments
Ability to measure electrical quantities using calibrated measuring instruments	Appropriately measures electrical quantities using calibrated measuring instruments	Measures electrical quantities using calibrated measuring instruments	Measure some electrical quantities using calibrated measuring instruments	Hardly measures electrical quantities using calibrated measuring instruments

STRAND 3.0: ELECTRICAL INSTALLATION

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question(s)
3.0 Electrical Installation	**3.1 Generation, Transmission and Distribution of Electricity** **(14 lessons)**	By the end of the sub strand, the learner should be able to: a) describe methods of generation of electrical energy, b) explain the functions of components in the electrical power transmission network, c) draw a 3-phase 4 wire distribution circuit of a power line, d) model an electric power Grid network, e) appreciate the importance of a grid system in a country.	The learner is guided to; ● use digital or print media to search for information on methods of generation of electrical power and present findings to peers, ● use print or audio visual media search for information on the functions of components of a power transmission system, ● use locally available materials to model a 3-phase 4 wire distribution circuit in power lines.*(phase symmetry and voltages - line to line and line to neutral),* ● create a model of electric power grid network using locally available materials, ● discuss with peers the importance of a grid system in a country.	1. How is electricity generated and transmitted to the consumer? 2. What is the importance of a power grid?

Core competencies to be developed: ● Citizenship: learner demonstrates critical inventive thinking when using locally available materials to model a 3-phase 4 wire distribution circuit in power lines. ● Digital Literacy: Learner uses digital devices to effectively access audio visual media to illustrate the functions of components of a power transmission system.
Values: Responsibility as the learner creates a model of electric power grid network using locally available materials.
Pertinent and Contemporary Issues (PCIs): Safety and security: as a learner discusses with peers the importance of a grid system in a country.

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question(s)
3.0 Electrical Installation	**3.2 Equipment at Consumers intake point** **(12 lessons)**	By the end of the sub strand, the learner should be able to: a) identify equipment at consumers electrical power intake point, b) describe the functions of control equipment at the consumer's intake point, c) install control equipment at the consumer's intake point in the correct sequence, d) prepare consumer earthing point according to guiding regulations in a building, e) appreciate the importance of the control equipment at the consumer intake point.	The learner is guided to; • use digital devices or print media, to search for information on the equipment at the consumer's electrical power intake point, • visit a consumer intake point within a building or watch a video to identify the functions of equipment used in the supply of electricity to a consumer *(isolation switch, meter, circuit breaker, cartridge fuse),* • use workshop materials and tools to install of equipment at the consumer's intake point in the correct sequence, *(isolation switch, meter, main switch, cartridge fuse, consumer control unit),* • use appropriate hand tools to excavate and drive in and/or bury an earth electrode at an	1. How is electrical power controlled at the intake point? 2. Why does input equipment at the intake point follow a certain sequence of connection?

			appropriate building location and connect to the installation, • discuss with peers ~~about~~ on the importance of equipment at the consumer intake point.	

Core Competencies to be developed:

- Communication and collaboration: learner speak clearly and effectively using appropriate language, expression and gestures as they discuss about the importance of equipment at the consumer intake point
- Critical thinking and problem solving: learner demonstrate ability to follow instructions to complete a task while installing earth electrode
- Learning to learn: learner reflect on their own work of installation of equipment at the consumer's intake point in the correct sequence and adjust accordingly

Values:

- Unity: learner works harmoniously with peers as they install earth electrode
- Responsibility: learner takes care of hand tools used for installation of equipment at the consumer's intake point
- Peace: learner cordially engages with peers as they discuss about the importance of equipment at the consumer intake point

Pertinent and Contemporary Issues (PCIs):

- Safety and Security: learner observe electrical rules and regulations as they perform installation works
- Waste management: learner practices environmental conservation as they properly dispose wastes after an electrical installation works

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question(s)
3.0 Electrical Installation	**3.3 Final Circuits** (20 lessons) .	By the end of the sub strand, the learner should be able to: a) describe the final circuits in an electrical installation, b) interpret an electrical diagram according to established standards, c) prepare a list of tools and materials required for a final circuit installation task, d) install final circuits in an electrical installation work according to regulations, e) value the need for final circuits in an installation,	The learner is guided to; • use digital devices or print media to search for information on the final circuits in an electrical installation *(lighting, power, cooker, bell, heating),* • use drawing materials and equipment to draw electrical wiring diagrams *(layout, circuit),* • compile a list of tools and materials for use in a final circuit installation task (*bill of material, tools requisition form*), • carry out installation and testing of final circuits in a workstation *(utmost 3 switches, and 2 lamps/bells),* • discuss with peers the need for final installation circuits and make presentations.	1. How are final circuits connected? 2. Why are final circuits important?

Core Competencies to be developed:

- Communication and collaboration: as the learner contributes to group decision making while he/she participates in discussions with peers on the need for final installation circuits and make presentations.
- Critical thinking and problem-solving: as the learner interpret and makes inference while carryout installation and testing of final circuits in a workstation.
- Creativity and imagination: as the learner undertakes imagination to generate new ideas while use drawing materials and equipment to draw electrical wiring diagrams

Values: ● Responsibility: as the learner exercise workshop safety while carryout installation and testing of final circuits in a workstation ● Integrity: as the learner is committed to duty while use drawing materials and equipment to draw electrical wiring diagrams
Pertinent and Contemporary Issues (PCIs): ● Socio-economic and environmental issues: as the learner takes care of the environment while carryout installation and testing of final circuits in a workstation ● Life skills: as the learner interacts with peers while discussing with peers on the need for final installation circuits and make presentations

Suggested Assessment Rubric

Indicator	**Exceeds expectation**	**Meets expectation**	**Approaches expectation**	**Below expectations**
Ability to identify circuit protective devices for an electrical installation.	Precisely and correctly identifies circuit protective devices for an electrical installation.	Correctly identifies circuit protective devices for an electrical installation.	Somewhat identifies circuit protective devices for an electrical installation.	Identify circuit protective devices for an electrical installation.
Ability to describe the functions of control equipment at the consumer's intake point.	Comprehensively and correctly describes the functions of control equipment at the consumer's intake point.	Correctly describes the functions of control equipment at the consumer's intake point.	Partially describe the functions of control equipment at the consumer's intake point.	Partially describes the functions of control equipment at the consumer's intake point.

Indicator	Exceeds expectation	Meets expectation	Approaches expectation	Below expectations
Ability to install equipment at the consumer's intake point in the correct sequence.	Precisely and correctly install equipment at the consumer's intake point in the correct sequence.	Correctly installs equipment at the consumer's intake point in the correct sequence.	Installs equipment at the consumer's intake point in the correct sequence.	With assistance install equipment at the consumer's intake point in the correct sequence.
Ability to prepare consumer earthing point according to guiding regulations in a building.	Correctly prepares consumer earthing point according to guiding regulations in a building.	Prepares consumer earthing point according to guiding regulations in a building.	Partially prepares consumer earthing point according to guiding regulations in a building.	With assistance prepares consumer earthing point according to guiding regulations in a building

STRAND 4.0: ELECTRONICS

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question(s)
4.0 Electronics	**4.1 Semiconductor Theory** (15 lessons)	By the end of the sub strand, the learner should be able to: a) explain the characteristics of semiconductor materials, b) describe the doping process in semiconductors, c) simulate covalent bonding in extrinsic semiconductors, d) illustrate formation of a PN junction of a semiconductor, e) appreciate the importance of electronic materials in electronic engineering.	The learner is guided to; ● use digital and print media to search for information on characteristics of semiconductor materials *(atomic structure, intrinsic, extrinsic and conductivity),* ● use audio visual and printed resources to search for information on the doping process of semiconductors, ● use role playing to simulate covalent bonding of P-type and N-type semiconductors *(holes, electrons),* ● create a model of PN junction using locally available materials,	1. How does a semiconductor material conduct electricity? 2. How is doping in semiconductors achieved?

			• watch videos on formation of depletion layer in a PN junction, • brainstorm with peers on the importance of doping in electronics.	

Core competencies to be developed:

- Communication and collaboration: learner acquires listening and speaking skills as they discuss the atomic structure of semiconductor, donor and acceptor elements in the periodic table.
- Creativity and imagination: learner acquires innovative skills as they use locally available materials to create a model of covalent bonding of P-type and N-type semiconductors.

Values:

Respect: learners appreciate diverse opinions as they brainstorm with peers on the importance of doping in electronics.

Pertinent and Contemporary Issues (PCIs):

Disaster risk reduction and management: learner acquires skills to mitigate risks related to safety when role playing to simulate covalent bonding of P-type and N-type semiconductors.

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question(s)
4.0 Electronics	**4.2 Semiconductor Diodes** **(16 lessons)**	By the end of the sub strand, the learner should be able to: a) describe the operation of a semiconductor diode, b) explain the current – voltage characteristics of semiconductor diodes, c) construct diode circuits for use in a workplace, d) Troubleshoot diode circuits in electrical appliances, e) appreciate the importance of semiconductor diodes in day to day life.	The learner is guided to; ● use digital and print media to search for information on the principle of operation of semiconductor diode (*Forward biasing, reverse biasing, electron-hole recombination*), ● perform experiments using a diode, power supply, voltmeter and ammeter to establish the voltage -current characteristics of diodes ● assemble and test diode circuits for different applications *(rectification, regulation, display, switching),* ● Use measuring and test equipment to trace faults in diode circuits (short circuit, open circuit, faulty diodes) ● brainstorm with peers on the types of diodes and their application in home and public transport systems (*LEDs, Zener, power diodes, infrared, signal),* ● use diode based concepts to design domestic and public transport safety	1.How does a semiconductor diode work? 2.How are diodes selected for use in a given circuit?

			solutions. (Smart traffic lights and sensors for pedestrian crossings).	

Core competencies to be developed:

- Critical thinking and problem solving: learner explores different options while constructing diode circuits for different applications
- Communication and collaboration: learner demonstrates teamwork while contributing to group discussion on applications of the different types of diodes and make presentations

Values:

- Love: learner respects others opinions while discussing and making presentations on the applications of the different types of diodes
- Social justice: learners accord each other equal opportunities in sharing responsibilities while constructing and testing diode circuits for different applications
- Integrity: learner displays honesty search and presenting factual information on the principle of operation of semiconductor diode

- **Pertinent and Contemporary Issues (PCIs):**
  Effective communication: learner practice to communicate their ideas as they brainstorm with peers on the types of diodes and their application in electronics
- Self-management skills: learner organises themselves as they discuss with peers on the applications of the different types of diodes and make presentation

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question(s)
4.0 Electronics	**4.3 Transistor** (16 lessons)	By the end of the sub strand, the learner should be able to: a) describe the operation of semiconductor transistors, b) verify the voltage versus current characteristic of transistors, c) select an appropriate transistor for a given application, d) construct transistor circuits in a workplace, e) appreciate the importance of transistors in electronics.	The learner is guided to: ● use digital or print media to search for information on construction and operation of Bipolar Junction Transistor (BJT) and Field Effect Transistor (FET), ● perform experiments to measure transistor voltage and current and plot the transistor voltage versus current DC characteristics, ● brainstorm with peers on the types of transistors and their applications in electronics *(BJT, FET)*, ● assemble and test a transistor switching circuit, ● discuss with peers on the applications of the different types of	1. How does a transistor operate in an electronic circuit? 2. Why are transistors important in electronics?

			transistors and make presentations.	

Core competencies to be developed:

- Critical thinking and problem-solving: learner interprets and makes inference while performing experiments to measure transistor voltage and current for use in plotting the transistor voltage versus current DC characteristics.
- Digital literacy: learner accesses information while searching for information on construction and operation of Bipolar Junction transistor (BJT) and Field effect transistor (FET).
- Learning to learn: learner carries out investigation while assembling and testing a transistor switching circuit.

Values:

- Responsibilities: as the learner exercises laboratory safety while experiments to measure transistor voltage and current for use in plotting the transistor voltage versus current DC characteristics.
- Integrity: as the learner applies laid down procedure while assembling and testing transistor switching circuit.

Pertinent and Contemporary Issues (PCIs):

Life Skills: as the learner interact with each other while discussing on the applications of the different types of transistors and make presentations

Suggested Assessment Rubric

Indicator	Exceeds Expectation	Meets Expectation	Approaches Expectation	Below Expectation
Ability to explain the characteristics of semiconductor materials,	Comprehensively and accurately explains the characteristics of semiconductor materials,	Accurately explains the characteristics of semiconductor materials,	Partially explains the characteristics of semiconductor materials,	Can explain the characteristics of semiconductor materials,
Ability to describe the doping process in semiconductors	Comprehensively and accurately describes the doping process in semiconductors	Accurately describes the doping process in semiconductors	Partially describes the doping process in semiconductors	Can describe the doping process in semiconductors
Ability to simulate covalent bonding in extrinsic semiconductors	Accurately and consistently describe the doping process in semiconductors	Accurately describe the doping process in semiconductors	Can describe the doping process in semiconductors	Can describe the doping process in semiconductors
Ability to illustrate formation of a PN junction semiconductor	Precisely and accurately illustrate formation of a PN junction semiconductor	Accurately illustrate formation of a PN junction semiconductor	Partially illustrate formation of a PN junction semiconductor	Can illustrate formation of a PN junction semiconductor

APPENDIX: LIST OF ASSESSMENT METHODS, LEARNING RESOURCES AND NON-FORMAL ACTIVITIES

Strand	Sub Strand	Suggested assessment methods	Suggested learning resources	Suggested non-formal activities
1.0 Fundamentals of Electrical Technology	**1.1 Introduction to Electrical Technology**	• Written tests • Portfolio • Observation of learning activities. • Oral assessment	• Career brochures • Digital devices for searching information on career • Career resource person • First aid kit • Assorted electrical PPEs • Drawing boards • TEE squares • Draughtsman's set • Set squares 30 – 60, 45	Invite industry professionals to talk about their work, current technologies, and career paths in electrical technology Pair students with mentors from the industry who can provide guidance on projects and career advice
	1.2 D.C Electric Circuit	• Practical tasks • Observation of learning activities • Written tests	• Cells • Connecting wires • Ammeters and voltmeters • Assorted resistors • Assorted bulbs • Potentiometers • Rheostats • Video clips on	Organize workshops where students can build simple circuits, solder components, and work on small practical circuits
	1.3 Capacitors and Capacitance	• Practical tasks • Observation of learning activities	• Assorted sample capacitors • Ammeters and voltmeters	Use digital devices and online simulators that allow students to test

		• Written tests	• Potentiometers • Rheostats • Simulation Software	capacitive circuits in a virtual environment
	1.4 Cells and Batteries	• Written test • Observation of nursery management practices or harvesting activities • Project work	• Sample Cells and batteries • Assorted Bulbs • Connecting wires	Participate in maintenance of cells and batteries at home and the community cleaning
2.0 Electrical Machines	**2.1 Magnetism**	• Practical tasks • Observation of learning activities	• Magnetism Kits • Assorted Permanent bar magnets • Ferromagnetic and non-magnetic materials • Magnetic compass	Learners observe and record the effects of magnetic fields on various objects and materials, like placing magnets near electronic devices or observing how magnetic fields affect real world activities
	2.2 Electromagnetism	• Practical tasks • Observation of learning activities	Bars of Magnetic materials Bar magnets Solenoids Cells Cell holders	Learners make their own magnetic compasses using simple materials like needles, cork, and water, and explore how they work.

	2.3 Measuring Instruments	• Practical tasks • Observation of learning activities	Multimeters Ammeters Ohmmeters Voltmeters Digital devices Model circuits	Learners get involved in practical activities that benefit the community, such as electrical fault finding and helping with electrical repairs at home and in the community.
3.0 Electrical Installation	**3.1 Generation, Transmission and Distribution of Electricity**	• Practical Tasks • Observation of learning activities • Oral questions	Conduits Domestic installation cables of varied size	Learners visit local power plants, electrical substations, or factories.
	3.2 Equipment at the Intake Point	• Written tests • Observation of learning activities • Oral questions	Assortment of switches SPST, SPDT, DPST, DPDT,	Learners visit local domestic houses to observe equipment at the intake point
	3.3 Final Circuits	• Observation of practical • Written tests • Practical tasks • Project work	Combination pliers Cable stripper Vice grip Assorted hammers Mallet (plastic head) Cable puller wire	Students work on projects that solve real-world problems, like improving home electrical systems.

4.0 Electronics	**4.1 Semiconductor Theory**	• Written tests • Practical tasks • Observation of learning activities	Semiconductor Kits Rectifier Diodes Zener Diodes Light Emitting Diodes Light Dependent Resistor Simulation Software	Utilise online circuit simulators to model and analyze semiconductor circuits. This allows students to experiment with different circuit designs without the need for physical components.
	4.2 Semiconductor Diodes	• Written tests • Practical tasks	Diodes Resistors Bread boards Cathode Ray Oscilloscope Signal generator	Learners experiment with real world diode circuits And build project work on diodes circuits
	4.3 Transistors	• Written tests • Practical tasks • Project work	Transistors Resistors Transistor circuits Bread boards	Learners partner with others from other pathways for interdisciplinary projects Learners experiment with electronic components, experiment with different circuits, and troubleshoot problems.

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