



NATIONAL CERTIFICATE

IN

ELECTRICAL INSTALLATION SYSTEMS

AND MAINTENANCE

(NCES)

SYLLABUS

FOR

TECHNICAL AND VOCATIONAL INSTITUTES



THE REPUBLIC OF UGANDA
Ministry of Education Science Technology and Sports

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Ms. Grace K Baguma

Director

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Foreword

Improvement of the curricula for Technical Certificate Courses is part of the Ministry of Education Science Technology and Sports' (MoESTS) strategy (2008), for the provision of technical and vocational education. Technical and Vocational institutes are the institutions producing technicians in the country among others. The Government of Uganda aims at providing technical, scientific and vocational skills for the majority of Ugandans, in line with its emphasis on the BTVET strategic plan of "Skilling Uganda".

The development of this curriculum started with a survey of the world of work, which included employers and graduates of technical certificate courses. A report from the survey culminated into the development of a Professional Profile, which includes all jobs and tasks that the graduates of Electrical installation systems and maintenance. This led to the development of all modules in this curriculum.

This curriculum is updated with current labour market demands and it is learner-centred and competence-based. It focuses on core tasks and assignments. It begins with a preparatory assignment and each academic year involves execution of a real life project that makes the technician competent in the trade. It aims at making Technical and Vocational Institutions the centre of excellence for technical education and skills development in the region, which will result into greater development and industrialisation of the country.

Dr. Rose Nassali Lukwago

Permanent Secretary

Ministry of Education Science Technology and Sports

List of Acronyms

ABC	Abstinence Be faithful use Condom
BCC	Behaviour Change and Communication
BTVET	Business Technical Vocational Education and Training
CD	Curriculum Development
CGPA	Cumulative Grade Point Average
CH	Contact Hours
CTF	Curriculum Task Force
CU	Credit Units
DES	Directorate of Education Standards
DIT	Directorate of Industrial Training
ELTE	Electronic Learning and Teaching Environment
GP	Grade Point
HCF/M	Highest Common Factor/ Multiple
HCT	HIV Counselling and Testing
HDME	Higher Diploma in Mechanical Engineering
HIV/AIDS	Human Immune Deficiency Virus/ Acquired Immune Deficiency Syndrome
KES	Kyambogo Engineering Service
LCM	Lowest Common Multiple
	Maintenance core modules
MOESTS	Ministry of Education, Science, Technology and Sports
MoH	Ministry of Health
MOLGSD	Ministry of Labour, Gender and Social Development
NCDC	National Curriculum Development Centre
NCES	National Certificate in Electrical Installation Systems and Maintenance
NCHE	National Council for Higher Education
NDEE	National Diploma in Electrical Engineering
NGO	Non-Governmental Organisation
NP	Normal Progress
NVQF	National Vocational Qualification Framework
NWY	Number of Weeks per Year
PEP	Post Exposure Prophylaxis
PH	Practical Hours
PLC	Programmable Logic Controller
PLHIV	People Living with HIV and AIDS
PP	Probationary Progress
PPDA	Public Procurement Disposal of Assets
RTI	Research Triangle International
SACCO	Saving and Credit Co-operative
SHE	Safety Health and Environment
SJA	Safe Job Analysis
SMC	Safe Male Circumcision
SPEAR	Supporting Public Sector Workplace to Expand Actions and Responses to
HIV/AIDS	

STI's	Sexually Transmitted Infections
TC	Technical Certificate; module code letter identifiers for Certificate courses
TCBE	Technical Certificate course module code for Business Entrepreneurship Skills
TCCA	Technical Certificate course module code for Computer Applications
TCCS	Technical Certificate course module code for Life Skills
TCES	Technical Certificate course module code for Electrical Installation Systems and maintenance
TCHY	Total Contact Hours per Year
TCTM	Technical Certificate course module code for Applied Technician Mathematics
TH	Training Hours
TI	Technical Institute
TS	Technical School
UBTEB	Uganda Business and Technical Examinations Board
UNAIDS	The Joint United Nations Programme on HIV and AIDS
UNEB	Uganda National Examinations Board
UTC	Uganda Technical College
VAT	Value Added Tax
VS	Vocational School
VTI	Vocational Training Institute
WoW	World of Work

Introduction

This National Certificate in Electrical Installation Systems and Maintenance (NCES) curriculum is aimed at producing electricians who are relevant to the industry and world of work. It is learner-centred and competence-based and emphasizes acquisition of skills through practical teaching and execution of projects.

The curriculum emanated from the BTVET Act (2008), the BTVET Strategic Plan “Skilling Uganda” and Uganda Vision 2040.

The competences that the learner is expected to acquire are clearly spelt out in each module covered in each of the three terms of an academic year. The modules offered in this course are packaged in a manner that will enable the learner to attain particular skills required for performing tasks at any level of the respective academic year of study.

Modules such as Computer Applications, Basic Kiswahili and Life Skills, are aimed at enhancing the learner’s report writing, communication and presentation skills.

In addition, the following modules: Electrical Installation Science, Solar Energy, Engineering Drawing, Electrical Supply and Installation, Electrical Installation Systems and Design, Equipment Repair and Maintenance, Electrical Machines and Basic Electronics, industrial installation automation and Real Life Project are aimed at equipping the learner with the core hands-on skills and techniques in the field of Electrical Engineering .

Applied Technician’s Mathematics module is aimed at improving the learners’ ability to judge, make decisions, estimate, cost materials and labour, analyse data and understand trends in the world of work.

The Entrepreneurship Skills module provides the learner with the skills of starting up, managing and sustaining an enterprise in an ethical manner.

Industrial Training, which comes at the end of each academic year, is aimed at bridging the gap between the institution-based training and the world of work.

This curriculum, if implemented effectively, will produce Electricians who are able to:

- i) program and troubleshoot industrial automation systems and carry out electrical installation.
- ii) design, draw and interpret electrical circuits and drawings.
- iii) repair and maintain electrical and electronic appliances/ equipment
- iv) to erect, install and maintain transmission and distribution power lines.
- v) install and maintain a solar PV system.
- vi) initiate and manage small business enterprises.

Guidelines for Implementing the NCES Curriculum

Title of Course

The title of the Course is National Certificate in Electrical Installation Systems and Maintenance (NCES).

Duration of the Course

The National Certificate in Electrical Installation Systems and Maintenance is a full time course taught in **two** academic years. Each academic year consists of **three** terms. Terms one and two consist of **twelve (12)** weeks which comprise of **ten (10)** weeks of teaching and continuous assessment and **two (2)** weeks of practical and written examinations. Third term consists of **ten** weeks, which comprise of **eight** weeks of teaching and continuous assessment and **two (2)** weeks of practical and written examinations.

Industrial training is a core module carried out at the end of each academic year and lasts for **at least 6** weeks.

The course shall be completed within a timeframe of **five (5)** years from the time of enrolment and registration.

Entry Requirements

A candidate shall be eligible for admission to the National Certificate in Electrical Installation Systems and Maintenance course on meeting any of the following minimum qualifications:

a) Ordinary Level Entry Scheme (Uganda Certificate of Education)

The candidate should be a holder of Uganda Certificate of Education without restrictions on passes and the year of sitting **OR** its equivalent.

b) Certificate Entry Scheme

The candidate should be a holder of Uganda Junior Technical Certificate (UJTC), Community Polytechnic Certificate **OR** National Junior Vocational Certificate from a recognised institution **OR** its equivalent in technical / vocational education.

Prospects for National Certificate in Electrical Installation Systems and Maintenance

NCES graduates may opt to further their skills and education by offering a Diploma and eventually a degree in any of the following areas:

- i) Electrical Engineering
- ii) Telecommunications
- iii) Electronic and Software Engineering
- iv) Information and Communications Technology
- v) Any other related course/programme

Awards

- A learner who completes the course with at least 2.0 Cumulative Grade Point Average (CGPA) in all modules of the course shall be awarded a **classified** “**National Certificate in Electrical Installation Systems and Maintenance**” by the mandated examining body.
- A learner who completes the course and does not attain **at least** 2.0 Grade Point Average (GPA) in some modules shall be awarded a **competency class Certificate** in “**Electrical Installation Systems and Maintenance**” by mandated examining body. The “competency class Certificate” shall allow specialised upgrading and employment.
- A candidate will be considered to have acquired a competence on performing tasks required in the labour market. One must have attended **at least 75%** of the course and undergone both continuous assessment and end of academic year examinations.
- Continuous assessment shall be handled by training institutions and verified by the mandated examining body.
- On completion of year one a learner is entitled to a statement of results by the mandated examining body indicating grades obtained in each module respective.

Course Assessment

Coursework and Examination

An authorised examinations body will assess the NCES, and the following guidelines shall apply:

i) Real Life Project

The Real life project shall be assessed out of 100%. It shall consist of continuous assessment marks only awarded to learners by the instructor during practical sessions. The real life project shall be executed on practicum sites which may be within or outside the institution, at the institutional workshop, garages, and industries or in any other suitable location.

The real life assessment shall be based on both the final product and the process involved in making it.

An authorised Examinations Board shall only verify the authenticity of the awarded marks from the completed projects on the ground and learners’ participation through presentations.

The total duration of the project assessment shall be **28 weeks** of teaching and continuous assessment in an academic year.

The real life project shall be assessed out of 100 marks as follows:

• Design	20 marks
• Drawing	10 marks
• Bills of quantities	10 marks
• Actual Implementation	25marks
• Finishing and branding	20 marks
• Final report on project and Presentation	15 marks

TOTAL **100 marks**

ii) Other modules apart from real life project will be assessed out of 100 marks as follows:

• Continuous Assessment	40%
• Final Examination	60%

Continuous assessment shall consist of:

- Laboratory/practical work
- Tests
- Assignments consisting of;
 - Class work
 - Written questions to be answered from home (homework)
 - Reports from attended industrial visits, documentaries, Field visits and presentations by professionals
 - Practical execution and participation

Modules without practical work such as TCTM 101 Applied Mathematics I and TCTM 201: Applied Technician Mathematics II, will have continuous assessment as follows;

• Assignments	15 marks (homework /class work)
• Tests	25 marks
Total	40 marks

Modules with practical work such as Life skills TCCS 101; Basic Kiswahili TCCS 201; Computer Applications TCCA 101; Entrepreneurship Skills TCBE 201; Electrical Installation Science I TCES 101; Electrical Supply and Installation TCES 103; Engineering Drawing I TCES 102; Solar Energy I TCES 104; Electrical Installation Systems TCES 201; Equipment Repair and Maintenance TCES 202; Industrial Installation and Automation TCES 203 and Electrical Machines and Basic Electronics TCES 204 will be assessed as follows:

• Assignments	10 marks
• Tests	05 marks
• Practical work	25 marks
Total	40 marks

For continuous assessment, a learner shall undertake a minimum of **four (4)** assignments, **two (2)** tests and **four (4)** practical exercises per module.

Final Examination

Depending on the respective module examination paper format, the questioning techniques to be applied, should seek for the candidate's ability to remember, comprehend, apply, analyse, synthesise and evaluate conditions. All questions should be guiding the learner to perform the tasks expected of him/her in the world of work.

Industrial Training

All institutional administrators, instructors/teachers and learners should endeavour to identify placements for industrial training. A placement in this case is any place where technology, hands on skills and knowledge are being applied to produce items or provide services. This may include a workshop, a construction site, small or large manufacturing enterprises, a corporate organisation, a shop, a supermarket, a media house, a hotel, a lodge, a restaurant, a salon, a hospital etc.

The Industrial training assessment shall be conducted as follows:

- i. An industrial supervisor shall award 50% of the marks. This is because he/she is in contact with the learner and gives all the necessary practical teaching, support, guidance, correction, instruction and observation.
- ii. An academic supervisor shall visit the industry on appointment and award 30% of the marks. S/he shall interact with the learner in the presence of the industrial supervisor.
- iii. A written industrial training report shall be marked out of 20% and added to the industrial and academic supervisors' marks to make 100%.

The industrial training assessment forms for both industrial and academic supervisors are attached in the appendices II and III.

The mandated assessment body shall also verify the authenticity of the industrial training awarded marks at the industry during the training period by sending their representatives to visit industries where learners are placed.

Weighting System

- i) The instruction methods of a module under the programme involve classroom teaching, field visits and assessments, laboratory testing, tutorials, and practical work. Each module is weighted using the credit unit (CU). One credit unit is equivalent to 15 contact hours (CH).
- ii) A contact hour can either be a teaching or classroom-teaching hour (LH), tutorial hour (TH), field visit and assessment hour (FVAH) and/or practical hour (PH). A contact hour is equivalent to 1 classroom teaching hour or 2 tutorial hours or 2 practical hours/field visits.
- iii) Modules are weighted according to the number of CUs they carry, which are based on their core relevancy in the trade of specialisation. Hence a module weighted 2 CU would take 30 contact hours; 3 CU would take 45 contact hours and so on. A module shall contain a minimum of 2 CUs and a maximum of 5 CUs.

Grading

Each module shall be graded out of 100 marks according to the computed marks obtained from both the coursework and written examinations. The grade of certificate awarded to a student shall be according to the CGPA score. The final marks for a module shall be converted into Grade Points (GP) as follows:

Percentage mark range	Grade	Grade Point (GP)
80 – 100	A	5.0
75 – 79.9	B +	4.5
70 – 74.9	B	4.0
65 – 69.9	B –	3.5
60 – 64.9	C +	3.0
55 – 59.9	C	2.5
50 – 54.9	C –	2.0
45 – 49.9	D +	1.5
40 – 44.9	D	1.0
25 – 39.9	D –	0.5
00- 24.9	E	0.0

Calculation of Cumulative Grade Point Average (CGPA)

The CGPA shall be obtained by:

- i) multiplying the GP obtained by the credit units assigned to the module to arrive at the weighted score for the module.
- ii) adding the weighted scores for all modules taken up to the time.
- iii) dividing the total weighted score by the total number of credit units taken up to the time.

Classification

The National Certificate in Electrical Installation Systems and Maintenance shall be classified according to the CGPA obtained on the completion of the course as follows:

Class	CGPA
First Class	4.40 – 5.00
Second Class Upper Division	3.60 – 4.39
Second Class Lower Division	2.80 – 3.59
Third Class	2.00 – 2.79

Retaking a Module

- A learner may retake a given module to improve grades. Retaking means repeating the entire module, that is; attending lessons, doing continuous assessments and the final examination. There will be no special exams or tests. Should this learner get a lower grade during the retake, his/her original grade should prevail.
- A learner should be allowed a maximum of three retakes for each module.
- Whenever a module is retaken, the academic transcript should **not** indicate so.

Dead Year

A learner is allowed to apply for a Dead Year of study due to financial difficulties, sickness or other disasters and should be allowed to resume the course at the level she/he exited for the Dead Year. All learners applying for the Dead Year shall also have to complete the course within five years from the time of enrolment and registration into the course.

Academic Year Load

A learner shall carry a maximum of **30** credit units per academic year of study.

Maximum Modules per Academic Year of Study

Each academic year shall contain a maximum of **Eight** modules including project work.

Final Examinations Paper Format

Year 1

Paper Name and Code	Examination Format
TCTM 101: Applied Technician Mathematics I	Each paper shall consist of eight questions and the candidate will be required to answer any five . All questions shall carry equal marks. The questioning techniques to be applied should seek for the candidate's ability to remember, comprehend, apply, analyse, synthesise and evaluate conditions. Duration shall be three hours.
TCCS101: Communication Skills and HIV and AIDS Education	
TCES 101: Electrical Installation Science	
TCES 104: Solar Energy I	

TCES 102: Engineering Drawing	The paper shall consist of six questions and the candidate will be required to answer any four. All questions shall carry equal marks. The questioning techniques to be applied should seek for the candidate's ability to remember, comprehend, apply, analyse, synthesise and evaluate conditions. Duration shall be three hours.
TCES 103: Electrical Supply and Installation	The paper shall consist of two compulsory practical questions and the candidate will be required to answer all. Each question shall carry 50 marks. The assessment body shall send in advance cutting lists of materials required for the examinations to enable institutions prepare early. The assessment body shall send on site assessor to award the marks as candidates perform the tasks. The questioning techniques to be applied should seek for the candidate's ability to comprehend, apply, analyse, synthesise and evaluate conditions. The duration shall be three hours.
TCCA 101: Computer Applications	The paper shall consist of three questions carrying 50 marks each. A candidate will be required to answer any two questions. A print out of the practical outputs together with the softcopies of all files used will be sent to the assessing body. The questioning techniques to be applied should seek for the candidate's ability to remember, comprehend, apply, analyse, synthesise and evaluate conditions. The duration of this practical examination shall be two hours.
TCES 105: Real Life Project I	The paper shall consist of continuous assessment marks. The examinations board shall verify the authenticity of the awarded marks from the completed projects on the ground and learners' participation through presentations.

	The questioning techniques to be applied should seek for the candidate's ability to remember, comprehend, apply, analyse, synthesise and evaluate conditions. The duration of the examination shall be the period during the 28 weeks of teaching in an academic year of study.
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Year 2

Paper Name and Code	Examination Format
TCAM 201: Applied Technician Mathematics II TCBE 201: Entrepreneurship Skills TCES 201: Electrical Installation Systems and Design TCES 203: Industrial Installation and Automation TCES 204: Electrical Machines and Basic Electronic	Each paper shall consist of eight questions and the candidate shall be required to answer any five. All questions shall carry equal marks. The questioning techniques to be applied should seek for the candidates' ability to remember, comprehend, apply, analyse, synthesise and evaluate conditions. Duration shall be three hours.
TCES 202: Equipment Repair and Maintenance	The paper shall consist of two compulsory practical questions and the candidate will be required to answer all questions. Each question shall carry 50 marks. The assessment body shall send in advance cutting lists of materials required for the examinations to enable institutions prepare early. The assessment body shall send on site assessor to award the marks as candidates perform the tasks. The questioning techniques to be applied should seek for the candidate's ability to comprehend, apply, analyse, synthesise and evaluate conditions. The duration shall be three hours.
TCCS 201 Basic Kiswahili	The paper shall consist of two sections; A (General Kiswahili) and B (Professional Kiswahili). Section A shall consist of five questions and a candidate will be required to answer any three. Section B shall consist of three questions and a candidate shall be

	required to answer any two. All questions shall carry equal marks. The questioning techniques to be applied should seek for the candidate's ability to remember, comprehend, apply, analyse, synthesise and evaluate conditions. The total duration of the examination shall be three hours.
TCES 205: Real Life Project II	The paper shall consist of continuous assessment marks. The examinations board shall verify the authenticity of the awarded marks from the completed projects and learners' participation through presentations. The questioning techniques to be applied should seek for the candidate's ability to remember, comprehend, apply, analyse, synthesise and evaluate conditions. The duration of the examination shall be the period during the 28 weeks of teaching.

Focus of Education

The focus of education for NCES emphasises the following aspects of learning:

- i) competence-based.
- ii) real life practical assignments with supporting modules.
- iii) integrated education (knowledge, skills and positive attitude).
- iv) innovation and initiative (learning to solve problems that one has never encountered).
- v) upward mobility and concentric curriculum: first year gives a picture of the later years and the profession (intensification).
- vi) entrepreneurship and creativity oriented.
- vii) health, safety, security and environmental considerations.
- viii) sports, clubs and social interactions.
- ix) focus on the disabled, gender marginalised and equity.
- x) sustainability, professional practice, general and specialised law.
- xi) modularised courses
- xii) life skills

Assignment (Individual/Group)

Assignments to be done by learners shall either be individual-based or in groups. These will include:

- i) real-life (individual/group practical) projects
- ii) laboratory testing of materials
- iii) workshop practical exercises such as fitting, machining, welding and fabrication
- iv) classroom exercises/tutorials and practical exercises
- v) communications: oral presentation, email, and report writing
- vi) take-home assignments to test knowledge and ability to research
- vii) examinations and tests to gauge individual acquisition of knowledge and skills
- viii) site and industrial visits as well as case studies
- ix) information and communication technology (ICT)

Role of Learners

The learner should:

- i) participate fully in class work and assignments
- ii) be resourceful in group and personal research
- iii) seek guidance
- iv) learn to communicate - oral presentation, report writing and development of personal interactive skills
- v) learn to solve problems they have never faced before (initiation and innovation)
- vi) participate in community-based real life projects
- vii) assess the performance of staff and relevancy of courses
- viii) serve as ambassadors of the institution to the world of work
- ix) learn to work independently and as part of a team
- x) keep time and manage oneself and other people effectively
- xi) participate in sports, social and guild activities
- xii) participate in environment, health, safety and security awareness as well as preservation of activities
- xiii) practice leadership roles
- xiv) learn practical and entrepreneurship skills to enable them start up projects on their own
- xv) maintain discipline outside the Institution

Role of Teaching Staff

The teaching staff should:

- i) prepare schemes of work and lesson plans
- ii) keep records of attendance, assessment and discipline
- iii) serve as teachers, lecturers, supervisors and coaches
- iv) serve as consultants/supervisors for learners' projects and assignments
- v) assess learners' performance
- vi) contribute to continuing innovation in education
- vii) counsel and guide learners on career and social issues that may affect their studies
- viii) arrange for and carry out industrial training placement and supervision
- ix) arrange industrial tours and site visits

- x) prepare learners for project work as well as assess and record learners' progress
- xi) guide learners in project design and writing
- xii) collaborate in interdisciplinary activities
- xiii) assess effectiveness of the courses
- xiv) be ethical and role models to the profession
- xv) carry out research, write papers or publish technical books
- xvi) constantly update themselves on the industry's developments and requirements

Role of Non-Teaching and Support Staff

These should:

- i) ensure clean, healthy and attractive working and learning environment for learners and teachers
- ii) ensure timely delivery of materials and services for effective learning
- iii) maintain moral conduct
- iv) offer guidance and counselling to learners
- v) manage resources
- vi) ensure security of learners and the institute and their/its property
- vii) be flexible and willing to carry out any other duties assigned to them by the supervisors

Role of Administrative Staff

The administrative staff should:

- i) keep custody of Institute property (inventories)
- ii) plan for smooth running of the Institution (mobilise funds and human resources)
- iii) ensure equity and gender equality
- iv) link the Institution with government, world of work and other stakeholders
- v) support and facilitate learners' activities
- vi) carry out admission of learners
- vii) maintain and uphold the good image of the institution
- viii) ensure high academic standards of the institution
- ix) arrange for graduations and regular meetings of alumni
- x) maintain ethical and moral conduct
- xi) ensure a safe and conducive learning environment
- xii) provide learners with adequate materials
- xiii) allow and facilitate inter-institutional activities
- xiv) ensure co-curricular management and its implementation
- xv) appraise staff performance
- xvi) ensure security of learners and their property
- xvii) ensure discipline among staff and learners
- xviii) recommend for promotion or disciplinary action among staff
- xix) appraise other staff
- xx) provide regular support to teaching and learning process.

Effective Learning Environment

For successful implementation of NCES, an effective learning environment must be provided, which includes:

- i) adequate physical infrastructure such as classrooms, laboratories, workshops and libraries equipped with relevant teaching/learning resources.
- ii) electronic learning and teaching environment (ELE) such as computers, projectors, printers, photocopiers and printers to support teaching and learning processes.
- iii) materials such as models, audio-visual aids, books, manuals, journals and equipment that offer learners and teachers' professional situations.
- iv) adequate facilities to cater for administration and other logistical terms that adequately support the educational process.
- v) medical facilities, proper hygiene and sanitation, proper working and studying environment, good feeding, welfare and security for the learners and staff.
- vi) proper motivation and inspiration of staff and learners for them to commit to the certificate course.
- vii) adequate arrangement seminars, workshops and exhibitions, as well as sites and industrial visits.
- viii) a platform for learners and staff to air out their views such as representation on governing councils.
- ix) professional personnel to adequately maintain all facilities such as dormitories.

Co-curricular Activities

Co-curricular activities are part of the institution activities and they enhance the teaching/learning process. Therefore, the institution should ensure that there:

- i) are adequate sports and recreational facilities;
- ii) is an effective learners' guild through which sports, recreational, religious and cultural activities are channelled and organised, and supported by the institute administration without discrimination.

Professional Profile for NCES

This section describes the professional profile of the NCES.

Job Titles and Tasks of NCES

The main duties and tasks performed by graduates of **NCES** include the following:

Job Title	Duties / Tasks
Linesman	• Carries out switching of power systems • Supervises routine maintenance of equipment and distribution lines • In charge of installation and erection of new distribution lines and equipment • Checks quality of materials supplied and controls their usage • Reports daily and weekly progress of work • Ensures safety of equipment and of workers • Ensures proper care of materials, equipment and tools • Estimates, costs and measures work and materials • Prepares daily and weekly progress reports
Meter Reader	• Supervises meter reading and billing of consumers for power supplied. • Checks proper connection of consumers to the power distribution system. • Prepares disconnection of defaulting consumers. • Ensures that meters are properly connected (not tampered with).
Power Station Electrician	• Participates in maintenance and repair of electro-mechanical equipment • Participates in store requisitions and purchases • Ensures health, safety and welfare of workers and security of plant and infrastructure • Carries out community mobilisation • Prepares progress reports
Power System Operator	• Records power system operations • Switches and isolates power systems • Ensures safe working methods
Electrical Maintenance Foreman	• Supervises, services and repairs electrical installations and electrical and electronic equipment • Manages day-to-day running of the workshop • Makes departmental orders and store requisitions • Ensures safety at the workplace

Organisations that Employ (NCES) Graduates

A graduate of NCES may be employed in the following organisations:

1. Manufacturing / production, processing and service industries both in the private and public sector like hospitals
2. Power generation, transmission and construction projects
3. Construction companies, Public Works Department and rural development agencies
4. Oil and gas industries
5. Self-employment in installation and maintenance
6. Technicians in educational institutions

Core Tasks for NCES

The core tasks for the NCES technician are characterised as follows:

Core Task 1: To configure and connect programmable logic controllers (PLC) to devices	
Result	• Working automated machines/ devices
Working environment	• Automated production lines and machines and sites involving programmable logic controllers
Level of complexity	• Basic programming
Performance indicators	• Client satisfaction • Compliance with safety standards, rules and regulations • Correct response of device to PLC instruction
Methods, tools and equipment used in performing professional tasks	Methods • Study of electrical installation systems and maintenance • Production of a completed electrical installation • Fault diagnosis • Programming/configuration of devices Tools and equipment • Electrical equipment, tools and other relevant equipment • Computers and drawing equipment • Electrical testing and measuring equipment • PLC training kit

Core Task 2: To carry out electrical installation	
Results	• Successful completion of electrical installations

working environment	• Electrical workshops and sites involving commercial and domestic premises
Level of complexity	• Domestic and industrial electrical installations
Performance indicators	• Client satisfaction • Compliance with safety standards, rules and regulations
Methods, tools and equipment used in performing professional tasks	Methods • Study of electrical installation systems and maintenance • Inspection and testing of electrical installations • Production of a completed electrical installation • Fault diagnosis • Programming Tools and equipment • Electrical equipment, tools and other relevant equipment • Calculators, computers and drawing equipment • Electrical testing and measuring equipment • PLC training kit

Core Task 3: To design, draw and interpret electrical circuits and drawings	
Results	• Successful completion of wiring, circuit diagrams and drawings • Complete bill of quantities
Working environment	• Drawing office
Level of complexity	• Domestic and industrial electrical installations • Circuit diagrams
Performance indicators	• Client / consultant / contractor satisfaction • Compliance with safety standards • Realistic / affordable/ economic design
Methods and facilities used in performing professional tasks	Methods • Desk and on-site study • Production and interpretation of electrical and electronic circuit diagrams and wiring drawings

	Facilities Calculators, computers, drawing instruments and materials
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Core Task 4: To repair and maintain electrical and electronic appliances/ equipment	
Results	- Complete repair of equipment - Functioning electrical and electronic equipment
Working environment	Workshop, customer sites, power stations
Level of complexity	Electrical appliance equipment up to 415V
Performance indicators	- Client satisfaction - Compliance with safety standards and regulations - Completion in time and within costs and to the required quality
Methods, equipment and facilities used in performing professional tasks	Methods - Test and approve materials - Check and monitor performance of workers - Check and monitor safety, health, welfare and security of workers - Check and monitor performance and security of the plant and equipment - Motor and transformer rewinding Equipment and Facilities - Maintenance specifications - Testing equipment - Safety standards - Electrical equipment and tools - Motors and transformers - Motor/transformer rewinding machine - Copper wires

Core Task 5: To erect, install and maintain transmission and distribution power lines	
Results	• Successful completion of installation and maintenance of transmission and distribution power lines.
Working environment	• Customer Sites
Level of complexity	• Voltages (up to 11K V) •
Performance indicators	• Meeting targets and budgets • Compliance with electricity safety standards • Completion in time and within costs
Methods, equipment and tools used in performing professional tasks	Methods • Test and approve materials • Check and monitor construction progress • Check and monitor performance of workers • Check and monitor safety and health of community • Check and monitor safety, health, welfare and security of workers • Check and monitor performance and security of the plant and equipment Equipment and Tools • Electrical testing tools and equipment • Safety standards • Distribution and transmission line construction equipment and tools

Core Task 6: To initiate and manage small business enterprises	
Results/outputs	Well managed and profit making business
Working environment	Workshops, hardware shops, fabrication construction sites, self started enterprises and firms
Level of complexity	Small and medium scale enterprises
Performance indicators	• Profit making • Satisfaction of customers and all parties involved • Smooth running of business activities

Methods, equipment and facilities used in performing professional tasks	Methods • SWOT analysis and scanning the environment • Copying from existing businesses • Creativity • Responding to the environmental needs • Market research • Costing/pricing • Advertising/ promotion Facilities and equipment • Business plan • Computer and stationery • Tender documents
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Core task 7 : To install and maintain solar PV systems	
Results	• Successful completion of installation and maintenance of Solar PV Systems
Working environment	• Workshop, customer sites
Level of complexity	• Voltages (up to 250V)
Performance indicators	• Meeting targets and budgets • Client satisfaction • Compliance with electricity safety standards • Completion in time and within costs
Methods, equipment and tools used in performing professional tasks	Methods • Test equipment • Check and monitor construction progress • Check and monitor performance of workers • Check and monitor safety and health of community • Check and monitor safety, health, welfare and security of workers • Check and monitor performance and security of the plant and equipment Equipment and Tools • Electrical testing tools and equipment • Safety standards

Course Structure

Year 1 (All Modules are Core)		TCHY	NWY	CU
TCTM101	Applied Technician Mathematics I	112	28	4
TCCS 101	Life Skills	56	28	2
TCCA 101	Computer Applications	112	28	4
TCES 101	Electrical Installation Science	140	28	5
TCES 102	Engineering Drawing	56	28	2
TCES103	Electrical Supply and Installation	140	28	5
TCES104	Solar Energy	84	28	3
TCES 105	Real Life Project	112	28	4
Total		812		29
Recess Term				
TCEI 106	Industrial Training	288	6	5

Year 2 (All Modules are Core)		TCHY	NWY	CU
TCTM 201	Applied Technician Mathematics II	112	28	4
TCBE 201	Entrepreneurship Skills	84	28	3
TCCS 201	Basic Kiswahili	56	28	2
TCES 201	Electrical Installation Systems and Design	84	28	3
TCES 202	Equipment Repair and Maintenance	140	28	5
TCES 203	Industrial Installation and Automation	112	28	4
TCES 204	Electrical Machines and Basic Electronics	112	28	4
TCES 205	Real Life Project II	112	28	4
Total		812		29
Recess Term				
TCES206	Industrial Training	288	6	5

TCHY : Total Contact Hours per Year
 NWY : Number of Weeks per Year
 CU : Credit Units = (CHY / NWY)

Detailed Module Description of Year 1 Term 1

TCTM 101: Applied Technician Mathematics I

Duration: 40 Hours

Module Overview

This module is intended to enable the learner attain some mathematical skills that enable a technician to carryout measurements, estimates and to enhance one have the foundation knowledge required for upgrading. It introduces a learner to calculate the cost of materials, solve problems related to fractions, decimals, percentages, ratios and proportions, areas and volumes of different figures as well as apply the laws of indices and logarithms.

Learning Outcomes

By the end of this module, the learner should be able to:

- convert metric units and use them in costing of materials.
- calculate the areas and volumes of various objects.

Competences

The learner:

- converts millimetres to metres, kg to Newton's and tones.
- calculates numbers involving highest common multiple (HCM) and lowest common multiple (LCM).
- calculates percentages in relation to material costing.
- calculates areas of irregular objects using Simpson, mid ordinate and trapezoidal rules.
- interprets the drawings by taking scale rule measurements.
- uses the areas and volume calculation methods to cost the materials for a given task.
- applies the laws of indices in solving indicial equations.
- rationalises and manipulates indicial equations.
- evaluates the logarithms.

Detailed Module Description	Duration
Sub-module 1: Basic S.I Units and Arithmetic Algebra • Metric conversion of S.I Units • Fractions (LCM and HCM) and decimals • Percentages, ratios and proportions	08 Hours
Sub- module 2: Mensuration • Calculation of area, perimeter, volume and total surface area • Interpretation of given drawing/diagrams • Cost calculations • Areas of irregular figures [Simpson rule, mid ordinate rule, trapezoidal rule]	12 Hours
Sub- module 3: Indices and Logarithms • Laws of indices and standard form, fractional indices, negative indices • Indicial equation • Multiplication and division of indices • Rationalisation and equations involving indices • Rules of logarithms • Common logarithms, change of base • Equations involving logarithmic functions, exponential functions and	20 Hours

logarithmic graphs • Natural logarithms	
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TCCS 101: Life Skills

Duration: 20 Hours

Module Overview

The module equips the learner with skills applied in day-to-day interactions, writing; application letters, Curriculum Vitae (CV) and Minutes. It also helps in technical communications, note taking and gives basic knowledge on HIV and AIDS.

Learning Outcomes

By the end of the module, the learner should be able to:

- communicate effectively in the field of work.
- positively relate with the environment and prevent HIV and AIDS spread.

Competences

The learner:

- listens and takes notes.
- speaks, interacts and conducts meetings.
- makes an agenda and conducts meetings.
- refrains from communications which are against the standing orders of the firm.
- talks and relates well with others at the work place.
- writes personal CVs, field report, memos, delegation letters, claim letters, stake holders circulars, demand notices.
- prepares work shop paper for presentation.
- writes suitable adverts and announcements
- gives an account of the origin and history, prevalence rates and current trends of HIV and AIDS in Uganda.
- outlines some HIV/AIDS myths and misconceptions.
- educates the public about the myths, misconceptions, facts and prevention of HIV/AIDS.

Detailed Module Description	Duration
Sub-module 1: Introduction to Communication Skills • Fundamental skills: - Reading - Listening - Note taking and note making - Speaking and interaction skills • Conducting meetings and interviews • Interpersonal skills • Work place communication	6 Hours

Sub-module 2: Writing Skills - Academic writing: - Technical and scientific report writing - Curriculum vitae and resume' writing - Authority and delegation letters - Writing of circulars - Office and business writing: - Intra and inter-office communication - Business correspondence and memo writing - Advert and announcement writing	10 Hours
Sub-module 3: Introduction to HIV and AIDS - Background of HIV and AIDS : meaning, definition, history, current trends and prevalence - Myths and misconceptions on HIV and AIDS - Basic facts about HIV and AIDS	4 Hours

TCCA 101: Computer Applications

Duration: 40 Hours

Module Overview

This module is designed to; equip learner with computer skills of typesetting reports and other documents, enable the learner to use internet for searching, carry out simple connections and installations of a computer and its accessories.

Learning Outcomes

By the end of the module, the learner should be able to:

- use and manipulate a computer to prepare documents
- search web based information from the internet.

Competences

The learner:

- identifies different types of computers and describes the application of computer hardware, CPU, hard disc drives, modems, mouse, external speakers.
- removes and replaces computer components.
- identifies and uses key board buttons as per their functions.
- typesets data into the computer using key board.
- opens, closes, restarts and changes user accounts.
- describes computer operating system, types and functions.
- installs and uninstalls windows operating system, application software and other support programmes.
- locates the desktop start menu,

• creates desktop background and screen saver. • resizes, opens and closes windows by maximising and minimising to task pane. • copies files from external drive, CD, DVD and flash disc to the desktop. • identifies icons and their application. • starts, creates or opens a word window, works with text and manage files. • uses word menus for document editing; e.g. copy, paste, cut. • saves a document in different formats and to a storage media, e.g. flash disc. • formats a page and documents.	
Detailed Module Description	Duration
Sub-module 1: Introduction to Computer • Origin of computer • Types of computers and computer hardware (CPU, hard disk drives, modem, keyboard, etc) • Computer Accessories; scanners, projectors, external speakers • Keyboard basics; function keys, numeric keys and navigation keys • Starting a computer, closing down the computer (BOOTING) • Computer Software; classification, types, usage and Computer components; (video card, network cards, cables, ROM, RAM, monitors, printers, cameras, processors) • Safety, Health and Security of a computer	10 Hours
Sub-module 2: Operating System • Functions of an operating system • Types and classification of operating system and benefits of operating systems • Installation of windows operating system and application software	6 Hours
Sub-module 3: Desktop Main Menu • Start menu • Applications menu • Working with the desktop; background, screen saver • Manipulating open windows; resizing, maximising, minimising, task pane, and tiling windows etc • Copying files from different locations • Icons, files and folders	4 Hours
Sub-module 4: Word Processing • Starting, creating and opening a word window • Working with text • Word menus for document editing; e.g. copy, paste, cut • Saving a word document • Saving a document in different formats and to a storage media, e.g. flash disc • Formatting a page and documents; paper size, background colours • Working with tables; rows and columns • Working with drawings, ClipArt and pictures • Mail merging	20 Hours

TCES 101: Electrical Installation Science

Duration: 50 Hours

Module Overview

This module introduces the learner to the principles of direct and alternating current (DC and AC) which enables him/her to calculate the amount of current to be used.

Learning Outcomes

By the end of this module, the learner should be able to:

- take measurement of the house which is to be installed in metres.
- convert units: millimetres to metres, kilometres to metres, kilograms to grams, kilowatts to watts, millampere to ampere, kilovolts to volts, and kilo joule to joule.
- differentiate between alternating current and direct current.
- describe the application of capacitors.
- Build an inverter

Competences

The learner:

- distinguishes between the various electrical SI units, multipliers and sub- multipliers and their derivations.
- applies simple electron theory to the flow of electrons and conventional current.
- analyses an electrical circuit according to Coulombs' law in relation to charge and current.
- applies joules law of heating in electrical heating circuits.
- describes properties of materials.
- calculates mechanical advantage, velocity ratio and efficiency.
- determines balance of forces.
- determines the number of teeth for a given gear
- Calculate resistance, voltage and current in a circuit
- Connect resistors/ lamps in series and parallel
- Measures voltage across resistors/lamps
- Measures current in the resistor/ lamps
- Describe the factors that affect the resistance of a conductor
- identifies series, parallel, and series - parallel circuits.
- applies Kirchhoff's circuit laws and super position theorem in solving problems of electrical direct current circuits.
- distinguishes between cells and batteries.
- demonstrate by use of diagrams the difference between ring and radial D.C supply.
- relates power, energy and kilowatt hour in D.C circuit and perform simple calculations.
- discusses the D.C transient and their effect.
- charges and discharge a capacitor through a resistor.
- carries out measurement of voltage on a capacitor before charging and after charging through a resistor.
- illustrates using graphs the charging and discharging processes of a capacitor (current growth and decay).
- performs calculation involving charging and discharging of a capacitor.
- Demonstrate how switching operation of the circuit is done

• Design and build inverter control circuit	
Detailed Module Description	Duration
Sub-module 1: Structure of Matter and their Properties • SI units, multiples and sub-multiples • Simple electron theory including flow of electron and conventional current • Coulomb's law, charge and current • Joule's law of heating • Material properties; ductility, malleability, strength, elasticity, hardness, toughness, thermal conductivity, thermal insulation, electrical insulation, magnetic conductivity, plasticity	10 Hours
Sub-module 2: Machines • Mechanical advantages, velocity ratio and efficiency • Pulleys • Gears • Screws	08 Hours
Sub-module 3: Ohms Law • Current , voltage and Resistance; • Factors affecting resistance of a conductor - Temperature coefficient of materials, - Resistivity, cross sectional area, length	10 hrs
Sub-module 4: Direct Current Circuits and D.C Transient Effects • Series, parallel and series-parallel circuits • Kirchhoff's circuit laws • Super position theorem • Cells and batteries • Ring and radial D.C supply • Power, energy and kilowatt hour • Introduction to D.C transients and their effects • Charging and discharging a capacitor • Time constant for a C-R circuit • Transient curves for C-R circuit • L-R circuit (current growth, time constant, transient curves, current decay) • Switching circuit and switching operation	22 Hours

TCES 102: Engineering Drawing

Duration: 20 Hours

Module Overview

The module introduces the learner to the introduction of engineering drawing and plane geometry to equip him/her with drawing skills and interpretation of drawings.

Learning Outcomes

By the end of this module, the learner should be able to:

- draw and interpret the drawings.
- sketch freely with his/her hands.

Competences

The learner:

- identifies drawing instruments and use them to produce drawings.
- uses engineering drawing as a means of representation and communication.
- applies lettering techniques for labelling and dimensioning.
- applies the different types of lines in construction.
- draws triangles, circles, polygons, ellipses and rectangles.
- divides a triangle into equal parts.
- bisects a line and divides it into equal parts.
- constructs a triangle and inscribes and circumscribes circles to a drawn triangle.
- develops and transforms plane figures.

Detailed Module Description	Duration
Sub-module 1: Introduction to engineering drawing • Aims and purpose of engineering drawing • Use of drawing equipment (drawing board, drawing set, set squares, tee-square, scale rule, French curves and flexible rod • Types and sizes of drawing boards, drawing papers, tee squares i.e. (A0, A1 A2, A3, A4) • Drawing paper layout: types of title blocks and their application • Types of lines and their application • Lettering a drawing - printing styles	06 Hours
Sub-module 2: Plane Geometry • Simple plane figures • Transformation of plane figures • Loci and special curves	14 Hours

TCES 103: Electrical Supply and Installation

Duration: 50 Hours

Module Overview

The module equips the learner with the skills of transmitting and distributing power using correct cables and conductors to the final consumers and also observing workshop safety and the correct use of basic workshop tools.

Learning Outcomes

By the end of this module, the learner should be able to:

- observe workshop safety and regulations.
- describe workshop safety and regulations in the workshop.
- care and maintain basic tools in the workshop.
- demonstrate how power is generated, transmitted and distributed to the local consumer.
- Use correct cables and conductors
- Make cable joints

Competences

The learner:

- designs the layout of a workshop and explains requirements for their application.
- treats a causality resulting from electric shock or any form of accident in the workshop.
- uses safety wears when working in a workshop.
- draws displays and interprets safety poster.
- generates warning notices that guard the public from danger.
- applies Institute of Electrical Engineers' (IEE) regulations and supply regulations.
- protects the environment.
- cares and maintains tools.
- uses the correct tools in the first, second and third fix stages of electrical installations.
- describes the concept of electricity generation.
- identifies the different sources of power generation.
- identifies sources of renewable and non-renewable energy.
- differentiates between renewable and non-renewable sources of energy.
- draws different types of sources of energy
- differentiates a turbine from a generator.
- identifies components as applied to the grid system e.g. conductors, insulators and poles.
- rates the different transmission voltages.
- identifies different transmission and distribution voltages.
- identifies the components of the distribution system e.g. transformers, distribution lines, poles, insulators and meters.
- draws and illustrates the electric power distribution processes.
- rates different distribution voltages.
- describes a cable and an insulator.
- identifies types of conductor materials used in cables.
- identifies types of insulating materials used in cables.
- selects/uses the correct types of cable.
- makes and terminates cable joints.

Detailed Module Description

Duration

Sub-module 1: Workshop/Site Safety and Regulations • Workshop design, layout and requirements for application • Workshop hazards: fire, electric shock, accidents • First aid on treating an electric shock casualty • Safety wears like helmet, goggles, overalls, boots, gloves, etc • Safety posters • Electricity supply regulation and IEE regulations • Codes of practice • Statutory regulations (HSSE health and safety at work)	12 Hours
Sub-module 2: Basic Tools and Equipment • Identification and correct application of tools • Care and maintenance • First fix stage in installation • Second fix stage in electrical installation systems and maintenance • Identification and correct application of measuring instruments	08Hours
Sub-module 3: Generation • Sources of Power/energy generation - Renewable; solar, hydro, wind, geothermal, wave, tidal energies - Non-renewable sources of energy (nuclear, thermal, batteries and cells) • Power generation system; Turbine, Generator, Insulator, Cable, Conductor, Transformer, Insulator, Switchgear, Substation, Bus bars	06 Hours
Sub-module 4: Transmission • Types of transmission • The grid system • Components of the transmission lines: conductors, insulators, towers, jumpers, cross arm, guard ring, guy • Transmission voltages	04 Hours
Sub-module 5: Distribution • Types of distribution (overhead and underground distribution) • Types of poles (wooden, concrete, metallic) • Distribution voltages • Consumer supplies	06 Hours
Sub-module 6: Cables and Conductors • Definition of cable • Conductor materials used in cables • Insulating materials • Types of cables • Types of cable joints and terminations	14 hours

TCES 104: Solar Energy

Duration: 30 Hours

Module Overview

The module equips the learner with skills of identifying solar PV system components.

Learning Outcomes

By the end of this module, the learner should be able to identify solar PV components.

Competences

The learner:

- identifies and advises clients on the best situations that demand solar installations (applications, advantages and limitations of Solar PV technology).
- differentiates between solar cells and solar modules.
- identifies materials for the manufacture of cells.
- describes the manufacturing process of solar cells.
- Measure the voltage across the panel
- describes global warming and its effects.
- interprets weather and metrological data.
- uses metrological data to plan sites for solar PV installation.
- differentiates between diffuse and direct radiation.
- Differentiates between solar irradiance and insolation.
- Applies insolation data in photovoltaic system site planning.
- identifies components of a solar PV system.
- interprets specifications of components.
- chooses suitable components for the specific situations.

Detailed Module Description	Duration
Sub-module 1: Solar PV Technology • Applications of solar PV technology • Advantages of solar PV technology • Limitations of solar PV technology • Solar cells and modules	08 Hours
Sub-module 2: Solar Radiation • Global warming • Weather and metrological data • Application of insolation data in photo voltaic system	08 Hours
Sub-module 3: Components of a Solar PV System • Solar modules • Solar batteries • Charge controllers • Inverters • Power conditioning units	14 Hours

TCES 105: Real Life Project I

Duration: 40 Hours

Module Overview

The module introduces the learner to the concept of installing lighting circuits, power circuits, heating circuits, consumer unit, testing and earthing of a domestic installation and fabrication of electrical tools.

Learning Outcomes

By the end of this module, the learner should be able to:

- interpret a designed plan and also draw and design a plan.
- install a designed plan correctly and power it.
- use correct tools and equipment for the installation work.

Competences

The learner:

- fabricates electrical tools
- interprets the plan.
- redraws the plan.
- uses correct tools and equipment.
- marks and chases positions for conduits.
- bends conduits.
- erects conduits.
- seals the conduits to wall surface.
- Select the suitable cables for a particular purpose.
- draws in cables and fix accessories.
- makes cable joints and terminations.
- Builds an inverter
- observes safety precautions.
- tests for polarity, continuity and earthing.
- designs and constructs power inverters

Detailed Module Description

Duration

Proposed projects to choose from

An institution/instructor concerned and learners may choose and do any one project listed below in term 1, term 2 or term 3

A minimum of one project and a maximum of three projects may be carried in year one.

Any project done should be a reality and should be done as expected in the world of work.

Health, environment, safety and security (HESS) should be highly upheld by th

32 Hours

institution, instructor concerned and learners before, during and after project execution. 1. Fabrication electrical tools such as screw drivers, pliers 2. Design and construction of multipurpose extension cables using socket outs 3. Installation of lightning arrestors and their safety and security components on structures. 4. Installation of complete lighting circuits in at least two rooms 5. Installation of complete power circuits in at least two rooms 6. Installation of complete heating circuits. 7. Design and construction of power inverters	
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Detailed Module Description of Year 1 Term 2

TCTM 101: Applied Technician Mathematics I

Duration: 40 Hours

Module Overview

The module introduces the learner to trigonometry, matrices and their application in engineering. It gives the knowledge used in setting out structures and positioning of the technician's ladder/scaffolds.

Learning Outcome

By the end of this module, the learner should be able to apply trigonometry to set out simple templates.

Competences

The learner:

- calculates for the sine, cosine and tangent of a right angled triangle.
- determines the ladder safe leaning angles and roof pitches.
- manipulates trigonometrically ratios of 30° , 45° , 60° and their application in finding the areas of plots of land and other surfaces.
- draws trigonometric graphs.
- determines the heights and other distances or sides of triangles, areas of roofs and walls using the sine, cosine and tangent formulae
- adds and subtracts matrices.
- transposes matrices.
- calculates the determinants of matrices with linear equation.

Detailed Module Description

Duration

Sub-module 4: Trigonometry

26 Hours

- The general angle
- Pythagoras theorem
- Graphs of trigonometrical functions
- Trigonometrical ratios of 30° , 45° , 60°
- The sine formula
- Cosine formula
- Tangent formula
- Half angle formula
- Heights and distances

Sub- module 5: Matrices

14 Hours

- Addition and subtraction of matrices
- Multiplication and division of a square matrix
- Application, order and types
- Transpose and inverse of a square matrix
- Solution of sets of linear equations

TCCS 101: Life Skills

Duration: 20 Hours

Module Overview

The module is intended to enable the learners improve on their discourse writing skills, prepare and make presentations, and educate the public on the spread and control measures of HIV and AIDS.

Learning Outcomes

By the end of the module, the learner should be able to:

- logically make discourse writing.
- prepare and make presentations.
- change ones behaviour and protect self and others against HIV/AIDS.

Competences

The learner:

- correctly writes definitions of terms and descriptions of events in a logical manner.
- analyses the comparisons between two issues or objects and makes a correct decision.
- narrates the order in which events happened and gives objective arguments.
- prepares the seminar document and makes presentations.
- prepares a classroom report and makes a presentation
- prepares a public document and presents it.
- identifies and describes the modes of transmission of HIV/AIDS.
- identifies the risk factors and change in the behaviour required.
- manages risks and takes preventive measures.
- educates public and peers on risk behaviour and their management.
- demonstrates the best use of a condom.

Detailed Module Description	Duration
Sub-module 4: Discourse Writing • Definition and descriptive writing • Comparison and contrast • Narration and arguments	10 Hours
Sub-module 5: Presentations • Seminar document preparation and presentation • Class room report preparation and assessment presentations • Public document preparation and presentations	6 Hours
Sub-module 6: Spread and Control Measures of HIV and AIDS Modes of transmission • Risk factors • Prevention of HIV and AIDS • Behaviour change	4 Hours

TCCA 101: Computer Applications

Duration: 40 Hours

Module Overview

The module is intended to help learners carry out printing, scanning of documents and the use of internet.

Learning Outcomes

By the end of the module, the learner should be able to:

- prepare documents on spread sheets
- use the internet to search for the required information.

Competences

The learner:

- installs the printer to a computer.
- describes the procedure followed when printing documents.
- removes used up cartridges, toners and replaces or refills them.
- scans a document or pictures, saves and prints.
- uses internet and e-mail to search for notes, news and other required information.
- signs in and creates an e-mail address.
- copies and saves information from the Internet, downloading files, music, pictures to the computer.
- creates a strong password for the email address.
- connects two computers in one room to a LAN and share one printer.
- writes, sends, receives and reads mail messages.
- copies files and documents from one location to another.
- emerges, deletes and inserts excel cells.
- Makes and formats spread sheets
- prepares bills of quantities and applies excel formulae in adding, multiplying, subtracting and dividing figures.
- draws charts and graphs using excel.

Detailed Module Description	Duration
Sub-module 5: Printing, Scanning and Copying Documents • Printing documents • Working with printer cartridges and toners • Scanning documents and pictures • Copying • Safety, Security and Health precautions of Printing and Scanning gadgets	4 Hours
Sub-module 6 : Internet and E-mail • The Internet, web browsers • Opening a website; website address (url), • Internet searching and search engines • Saving information from the Internet, downloading files, music, pictures to the computer	16 Hours

• Electronic mail - Creating e-mail accounts - E-mail folders and attachments - Attaching documents to outgoing email - Downloading email attachment from incoming email - Formatting mail - Searching mail - Printing mail • Security, Safety and Health practices when using the internet and email	
Sub-module 7: Working with Spreadsheets • Creating an excel document • Opening and closing excel document • Entering data to a worksheet, editing and formatting a datasheet • Using formulas and functions • Creating/plotting charts and graphs from excel data values • Inserting tables to excel worksheet • Printing a spreadsheet; page setup, gridlines	20 Hours

TCES 101: Electrical Installation Science

Duration: 50 Hours

Module Overview

The module introduces the learner to electromagnetism and alternating fundamentals to enable him/her know the principle of direct and alternating current.

Learning Outcomes

By the end of this module, the learner should be able to:

- describe the principles of electromagnetism.
- demonstrate how to charge and discharge a capacitor.
- calculate the alternating quantities (current and voltage).

Competences

The learner:

- demonstrates the various applications of capacitors according to their types.
- illustrates using diagrams the two types of connections of capacitors (series and parallel) and the derivation of their total capacitances.
- Connect capacitors in series and parallel with the circuit.
- derives and applies the formula for the energy stored in a capacitor.
- applies magnetisms and electromagnetism principles to electrical machines.
- magnetises and demagnetise conductors and other metals like screw drivers.
- identifies the different poles of permanent magnets (south and north poles).
- Describes the application of magnets
- draws magnetic circuits and hysteresis loops and loss.
- applies the principles and laws of electromagnetism to practical D.C and A.C machines (e.g. motors, transformers, generators and other machines).
- distinguishes between mutual inductance and self-inductance.
- applies inductors in D.C and A.C circuits.
- calculates inductance
- illustrates by use of diagrams the differences between wave forms of AC and DC.
- distinguishes between unidirectional and alternating wave forms.
- calculates mean and runs values and forms and peak factors for given wave forms.
- combines two sinusoidal wave forms by plotting graphically and by calculation.
- calculates power in single phase A.C circuits and power factors.
- appreciates the importance of power factor improvement in industries.

Detailed Module Description

Duration

Sub- module 5: Electrostatics • Laws of electrostatics • Definitions (capacitance, laws of electrostatic field, electric field strength, electric flux density, permittivity) • Types of capacitors and their uses • Circuits and capacitor connections • Multi plate capacitor • Energy stored in a capacitor	14 Hours
Sub-module 6: Magnetism • Laws of magnets • Permanent magnets, electromagnets • Method of magnetisation and demagnetisation • Application of magnets • Magnetic circuits	10 Hours
Sub-module 7: Electromagnetism • Principles and laws of electromagnetism • Force on current carrying conductors • Hysteresis loop and loss • Inductors, mutual inductance and self-inductance	12Hours
Sub-module 8: Alternating Current Fundamentals • Introduction (alternating quantities current and voltage) • AC values (RMs, average, peak values form factor, peak factor) • The equation of a sinusoidal waveform • Combination of waveforms (by drawing and calculation) • Power in single phase AC circuits • Power factor and power factor improvement	14Hours

TCES 102: Engineering Drawing

Duration: 20 Hours

Module Overview

This module introduces the learner to tangent and solid geometry to enable him/her interpret and draw the plan in isometric.

Learning Outcomes

By the end of this module, the learner should be able to:

- change pictorial drawing from isometric to orthographic projection.
- draw the plan to scale and also interpret it.

Competences

The learner:

- draws tangents
- draw tangential arcs
- draws isometric and oblique projections.
- makes 3D/pictorial views.

Detailed Module Description	Duration
Sub-module 3: Tangents and tangency • Tangents • Principles of tangency	08 Hours
Sub-module 4: Solid Geometry • Pictorial drawings • Oblique projection • Isometric projection	12 Hours

TCES 103: Electrical Supply and Installation

Duration: 50 Hours

Module Overview

This module introduces the learner to wiring systems, control and protection and consumer installation to enable him/her know suitable wiring system to be used and how to install final circuits through protective devices.

Learning Outcomes

By the end of this module, the learner should be able to:

- fix the different types of fuses and circuit breaker.
- choose suitable fuses /circuit breaker for a particular installation.
- install the house using a suitable wiring system
- carry out the consumer's installation.

Competences

The learner:.

- selects a correct wiring system for a particular installation.
- Terminate the armoured cables
- Cut, bend and use conduits in an installation.
- installs at least two common wiring systems e.g. PVC- SWA and conduits.
- identifies basic requirements for installation of PVC-SWA, PILC-SWA, and MIMS, Metal conduits, Trunking, Cable trays, Ducting systems and Bus bars and wiring system.
- observes rules and regulations.
- Describe the main switch gears and protective devices.
- Installs main switch gears including protective devices.
- identifies and draws a sequence of control system and a consumer unit.
- wires up different types of lighting circuits, power circuits, water heater circuits, bell circuits, indicator boards alarm circuits and cooker circuits.
- installs fire and burglar alarm system.
- applies IEE regulations on above circuits.
-

Detailed Module Description

Duration

Sub-module 7: Wiring System

12 Hours

- PVC- SWA, PILC, MIMS, PVC conduits
- trunking system
- Metal conduits, trunking, cable trays
- Ducting systems, bus-bars
- Factors affecting the choice of wiring system (ambient temperature, moisture, corrosion, mechanical damage, damage by animals, ultra violet rays)
- Regulation requirements for each of the above wiring systems

Sub-module 8: Control and Protection • Main switch gears (for isolation and switching): isolators, switch fuses, fuse switches, circuit breakers, change over switches, distribution board/switch board, overload relay, contactors • Protective devices: re-wireable fuses to BS3036, cartridge fuses to BS 1361 and 1362, high breaking capacity fuses to BS 88, miniature circuit breakers to BS 3871 • IEE regulations for the above control and protective devices	16 Hours
Sub-module 9: Consumer's Installation • Supply sequence • Consumer unit • Lighting circuits (one way, two way and intermediate switching) • Power circuits (radial and ring circuits) • Water heater circuits • Cooker circuits • Installation of bell circuits (types of bells, bell indicators, bell relays, bell supplies, bell and call systems and segregation of circuits) • Alarm circuits (fire and burglar alarm system) • IEE regulations for the above circuits.	22 Hours

TCES 104: Solar Energy

Duration: 30 Hours

Module Overview

The module equips the learner with skills of identifying and sizing solar PV system components.

Learning Outcomes

By the end of this module, the learner should be able to:

- identify solar PV components.
- size solar PV components.

Competences

The learner:

- calculates correct sizes of components.
- compares the system cost with other alternatives.
- advises the client on the suitable PV system.
- makes bill of quantities.
- installs a solar PV System.
- uses proper tools.
- observes safety.
- identifies correct accessories for a particular solar system.
- Mounts solar modules.

Detailed Module Description

Duration

Sub-module 4: Solar PV System Sizing

15 Hours

- Site planning
- Determination of solar radiation of a locality
- Load energy consumption analysis
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Sub-module5: PV Installation

15 Hours

- Preparation (planning and transport)
- Good installation practice (wiring, switches, sockets, circuit breakers)
- Light fixtures
- Appliances
- Methods of mounting solar modules

TCES 105: Real Life Project I

Duration: 40 Hours

Module Overview

The module introduces the learner to the concept of installing lighting circuits, power circuits, heating circuits, consumer unit, testing and earthing of a domestic installation and fabrication of electrical tools.

Learning Outcomes

By the end of this module, the learner should be able to:

- interpret a designed plan and also draw and design a plan.
- install a designed plan correctly and power it.
- use correct tools and equipment for the installation work.

Competences

The learner:

- fabricates electrical tools
- interprets the plan.
- redraws the plan.
- uses correct tools and equipment.
- marks and chases positions for conduits.
- bends conduits.
- erects conduits.
- seals the conduits to wall surface.
- Select the suitable cables for a particular purpose.
- draws in cables and fix accessories.
- makes cable joints and terminations.
- Builds an inverter
- observes safety precautions.
- tests for polarity, continuity and earthing.
- designs and constructs power inverters

Detailed Module Description

Proposed projects to choose from

An institution/instructor concerned and learners may choose and do any one project listed below in term 1, term 2 or term 3

A minimum of one project and a maximum of three projects may be carried in year one.

Any project done should be a reality and should be done as expected in the world of work.

Health, environment, safety and security (HESS) should be highly upheld by the institution, instructor concerned and learners before, during and after project execution.

Duration

40 Hours

1. Fabrication electrical tools such as screw drivers, pliers 2. Design and construction of multipurpose extension cables using socket outs 3. Installation of lightning arrestors and their safety and security components on structures. 4. Installation of complete lighting circuits in at least two rooms 5. Installation of complete power circuits in at least two rooms 6. Installation of complete heating circuits. 7. Design and construction of power inverters	
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Detailed Module Description of Year 1 Term 3

TCTM 101: Applied Technician Mathematics I

Duration: 32 Hours

Module Overview

The module introduces the learner to the concepts of complex numbers, vectors and matrices, their relevancy in construction industry and further career upgrading. The knowledge attained on this module shall be more useful in analysing flow of fluids in pipes.

Learning Outcomes

By the end of the module, the learner should be able to:

- solve equations involving complex numbers.
- evaluate vectors.

Competences

The learner:

- represents the identities applied in complex numbers.
- adds and subtracts complex numbers.
- manipulates equal, polar and exponential forms equations of complex numbers.
- graphically represents complex numbers to standard forms.
- manipulates equations involving vectors, by addition, subtraction and multiplication.
- represents vectors on graphs.

Detailed Module Description

Duration

Sub-module 6: Complex Numbers

- Equal complex numbers
- Graphical representation of complex number
- Polar form of complex number
- Exponential form of a complex number

16 Hours

Sub-module 7: Vectors

- Introduction to vector representation
- Manipulation of vectors
- Types of vectors
- Addition of vectors
- Subtraction of vectors

16 Hours

TCCS 101: Life Skills

Duration: 16 Hours

Module Overview

The module introduces learners to oral and interpersonal communication skills , equips them with knowledge about the working environment and creating public awareness on the impact and interventions to combat HIV and AIDS.

Learning Outcome

By the end of the module, the learner should be able to:

- communicate effectively orally in the field of work.
- improve working environment for effective production and output.
- educate the public on the impact and interventions to combat HIV and AIDS in the Uganda.

Competences

The learner:

- develops basic listening skills.
- identifies the barriers to effective listening.
- develops public speaking principles.
- prepares for and conducts meetings.
- makes an agenda for the meeting and writes minutes.
- conducts interviews.
- describes the roles of chairperson and secretary to the meeting.
- educates public on importance of upholding good labour laws, good safety and health conditions at work.
- observes good labour laws and good safety and health conditions at work place and homes.
- practices good labour laws and good safety health.
- manages and encourages voluntary counselling and testing (VCT) among the public and peers.
- applies the qualities of a good counsellor during the counselling of the needy.
- guides and encourages clients to visit places where they can access treatment and care.
- describes impacts /effects of HIV/AIDS in the families, communities and the country.

Detailed Module Description

Duration

Sub-Module 7: Oral Communication Skills

06 Hours

- Listening and speaking
- Conducting meetings and interviews

Sub-module 8: Working Environment • Labour laws and regulations • Health and safety • Environment • Gender and mainstreaming of gender • Population growth / trends • Human rights • Social structure • Economic structure	04 Hours
Sub-module 9: Impact and Interventions of HIV and AIDS • Impact of HIV and AIDS • Interventions to combat HIV and AIDS • Counselling and testing • Treatment, care and support • Mitigation of stigma and discrimination • Disclosure of HIV status • HIV and AIDS workplace policy for Uganda	6 Hours

TCCA 101: Computer Applications

Duration: 32 Hours

Module Overview

The module enables the learner to acquire the required skills of working with presentations and basic networking for at least two computers.

Learning Outcome

By the end of this module, the learner should be able to connect at least two computers to one local area network and share a printer.

Competences

The learner:

- prepares and edits work on Ms power point slides.
- activates animations on the selected slide design.
- perfectly makes a PowerPoint Presentation.
- runs a full slide show.
- differentiates between wireless and cable networking.
- connects a network cable to computers.
- installs network modem to a personal computer.
- trouble shoots simple network connection problems.
- configures network to computers

Detailed Module Description	Duration
Sub-module 8: Power Point Presentations	14 Hours

• Creating a new presentation • Opening and closing a presentation • Saving a presentation document • Transferring a presentation to a storage media and different formats • Adding and formatting text, pictures and media • Creating and running a slideshow • Printing presentation slides	
Sub-module 9: Basic Networking • Introduction to computer networking • Types of network; WAN (Wide Area Networks), LAN (Local Area Network) • Types of communication media; cables, wireless, optic fibres • Local area network topologies; star topology, ring topology, mesh topology, bar topology • Connecting a computer to a network • Configuring an IPA (Internet Protocol Address) • Creating a simple network of at least two computers • Sharing files between computers on a simple network • Troubleshooting simple connection problems • Connecting and configuring a printer on a network • General Internet safety and security regulations	18 Hours

TCES 101: Electrical Installation Science

Duration: 40 Hours

Module Overview

The module introduces the learners to alternating currents, illumination and measuring instruments which equip the learner with the skill of calculating electrical quantities and how to space the lights.

Learning Outcomes

By the end of this module, the learner should be able to:

- determine voltages and currents to be used in electrical/electronic circuit.
- apply principles of alternating current and other systems applicable to electrical installation.
- measure electrical quantities using measuring instruments.

Competences

The learner:

- determines power in a pure resistive circuit, pure capacitive circuit and pure inductive circuit.
- Draws and plots graphs of voltage versus current and Calculate currents through pure resistive, pure capacitive and pure inductive circuits.

• calculates current and voltage in series, parallel and series parallel circuits. • determines power factor. • evaluates reactive, apparent and active powers. • describes conditions of resonance.. • describes generation of three phase supply. • plots three phase graphs. • Illustrates star and delta connection • evaluates power in balanced and unbalanced loads. • describes Illumination. • measures luminous intensity. • calculates lighting points. • describes inverse-square law and cosine law. • solves problems of lighting using methods of lighting calculations. • draws diagrams of moving coil and moving iron instruments. • takes measurements using moving coil and moving iron. • determines FSD. • calculates multiplier and shunt. • measures power. • observes wave forms. • determines minimum and maximum values and takes readings. • measures different quantities. • operates and Connect meters.	
Detailed Module Description	Duration
Sub-module 9: Single Phase AC circuits • Purely resistive, purely capacitive and purely inductive AC circuits • Series, parallel, and series-parallel circuits, resonance, q-factor, selectivity	10 Hours
Sub-module 10: Three Phase AC Circuits • Generation of three phase supply • Star connection • Delta connection • Power in three phase system • Balanced and unbalanced loads	10 Hours
Sub-module 11: Illumination • Concept of illumination and basic terms • Inverse-square law • Cosine law • Methods of lighting calculations	10 Hours
Sub-module 12: Measuring Instruments • Moving coil instruments • Moving iron instruments • Increasing the range of measuring instruments • Multi meters • Watt meters • Cathode-ray oscilloscopes	10 Hours

• Measuring electrical quantities • Energy metres	
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TCES 102: Engineering Drawing	
Duration: 16 Hours	
Module Overview This module introduces the learner to orthographic projection to enable him/her interpret and draw the plan.	
Learning Outcomes By the end of this module, the learner should be able to: • covert orthographic views to pictorial views. • draw the plan to scale and also interpret it.	
Competences The learner: • Draws 1st angle and 3rd angle orthographic. Projections • converts 1st and 3rd angle orthographic views to pictorial views.	
Detailed Module Description	Duration
Sub-module 5: Orthographic Projection • 1st angle projection • 3rd angle projection	16 Hours

TCES 103: Electrical Supply and Installation

Duration: 40 Hours

Module Overview

The module introduces the learner to lightning protection, earthing, testing and inspection which equips him/her with the skills of connecting lightning conductor on an installation, earthing and testing an installation.

Learning Outcomes

By the end of this module, the learner should be able to:

- describe the importance of earthing an installation.
- install the lightning protection system.
- test and inspect after an installation has been completed.

Competences

The learner:

- applies different earthing terms in the earthing process.
- identifies types of earthing/ methods.
- earths a domestic installation.
- tests earth electrode resistance.
- identifies places where lightning protection is required.
- identifies component of a lightning system.
- designs a zone of protection for a building.
- installs the lightning protection system
- identifies precautions to be taken against corrosion.
- carries out visual inspection.
- tests a domestic installation.
- certifies the completion of domestic installation.

Detailed Module Description	Duration
Sub-module 10: Earthing • Definition of earthing terms (earth, earth electrode, earth electrode resistance, main earth terminal, earth lead, circuit protective conductor (CPC), extraneous metal work bonding) • Purpose of earthing • Earthing system • Types of earthing (neutral and equipment earthing) • Earth loop impedance • Factors influencing earth resistance of electrodes, preparation of the pit, termination of the electrode) • Testing earth electrode resistance • Process of earthing (selection)	16 Hours
Sub-module 11: Protection Against Lightning • Factors to determine whether lightning protection is required • Components of a protection system	12 Hours

• Zone of protection • Installation of lightning protection • Corrosion precautions	
Sub-module 12 : Inspection and Testing • Visual inspection (broken components, sizes of components, quality of equipment) • Continuity tests carried out before supply connection, CPC and bonding conductors, ring circuits, polarity, insulation resistance • Earth electrode resistance • Test with supply connected (polarity with a test lamp, earth fault loop impedance, operation of residual current device) • Certification	12 Hours

TCES 104: Solar Energy

Duration: 16 Hours

Module Overview

The module equips the learner with skills of installing, maintaining and repairing a solar system.

Learning Outcome

By the end of this module, the learner should be able to

- install and repair a solar system.

Competences

The learner:

- troubleshoots the PV system.
- creates and maintains a PV system database.
- carries out routine maintenance.
- makes solar cookers, dryers.
- describes the operation of the solar water heater.
- installs solar water heater.
- generates electricity using sun rays.
- concentrates sunrays using solar concentrators.
- traps sun rays using plastic or glass.

Detailed Module Description

Duration

Sub-module 6: Maintenance of a PV System

08 Hours

- Testing/troubleshooting
- PV system database
- Routine maintenance

Sub-module 7: Solar Thermal Energy

08 Hours

- Solar cookers
- Solar water heaters
- Solar dryers
- Power generation
- Green house effect

TCES 105: Real Life Project I

Duration: 32 Hours

Module Overview

The module introduces the learner to the concept of installing lighting circuits, power circuits, heating circuits, consumer unit, testing and earthing of a domestic installation and fabrication of electrical tools.

Learning Outcomes

By the end of this module, the learner should be able to:

- interpret a designed plan and also draw and design a plan.
- install a designed plan correctly and power it.
- use correct tools and equipment for the installation work.

Competences

The learner:

- fabricates electrical tools
- interprets the plan.
- redraws the plan.
- uses correct tools and equipment.
- marks and chases positions for conduits.
- bends conduits.
- erects conduits.
- seals the conduits to wall surface.
- Select the suitable cables for a particular purpose.
- draws in cables and fix accessories.
- makes cable joints and terminations.
- Builds an inverter
- observes safety precautions.
- tests for polarity, continuity and earthing.
- designs and constructs power inverters

Detailed Module Description

Proposed projects to choose from

An institution/instructor concerned and learners may choose and do any one project listed below in term 1, term 2 or term 3

A minimum of one project and a maximum of three projects may be carried in year one.

Any project done should be a reality and should be done as expected in the world of work.

Health, environment, safety and security (HESS) should be highly upheld by the institution, instructor concerned and learners before, during and after project

Duration

32 Hours

execution. Below are sample projects 1. Fabrication electrical tools such as screw drivers, pliers 2. Design and construction of multipurpose extension cables using socket outs 3. Installation of lightning arrestors and their safety and security components on structures. 4. Installation of complete lighting circuits in at least two rooms 5. Installation of complete power circuits in at least two rooms 6. Installation of complete heating circuits. 7. Design and construction of power inverters	
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TCES 111: Industrial Training I

Duration: 288 Hours

Module Overview

The module introduces the learners to attachment and practical training in electricity supply industrial (ESI).

Learning Outcomes

By the end of this module, the learner should be able to:

- apply engineering knowledge and skills taught into the world of work.
- develop work ethics and professional responsibility.
- choose appropriate work upon completion of the course.
- write an engineering report.

Competences

The learner:

- conducts technical aspect of the job i.e. repair and maintenance, troubleshooting and innovativeness.
- communicates with other company workers.
- builds interpersonal relationships.
- writes a comprehensive report.
- observes safety and health precautions.
- applies good professionalism and attitude behaviour at work i.e. compliance to standards, follows work processes/procedure, maintains and understands ethical and professional responsibilities.

Detailed Module Description

Duration

Sub-module 1: Industrial Training

- Acquaintance of work environment
- Familiarisation with equipment and tools
- Acquisition of skills of repair and maintenance and installation of domestic installations
- Communication building interpersonal relationship and report writing
- Observance of safety and health precautions

288 Hours

Detailed Module Description of Year 2 Term 1

TCTM 201: Applied Technician Mathematics II	
Duration: 40 Hours	
Module Overview The module introduces the learner to elementary polynomials and binomial theorem, their application and importance in the manufacturing industry.	
Learning Outcome By the end of this module, the learner should be able to: • Manipulate expressions of equations • evaluate polynomial equations applied in vibrating systems of vehicles and structures • apply binomial theorem in determining oscillations and frequencies of materials	
Competences The learner: • evaluates independent variables. • transposes various formulae. • applies the transposition of formulae in manipulating and solving production-related problems. • factorises quadratic equations. • solves polynomial equations by applying the remainder theorem. • solves general polynomial equations. • expresses binomial theorem on Pascal's triangle. • manipulates binomial theorem equations.	
Detailed Module Description	Duration
Sub-module 1: Expressions of Equations • Evaluating expressions • Equations • Evaluating independent variables • Transposition of formulae	12 hours
Sub-module 2: Polynomial Equations • Polynomial expression, equations of polynomials • Remainder theorem • Factorisation of quadratic polynomials	14 Hours
Sub-module 3: Binomial Theorem • Expansion of binomial expressions: Pascal's triangle, the binomial theorem for 'n' a positive integer • The general binomial expansion $(1+x)^n$ for $1 < x < 1$ and for $1 < x > 1$	14 Hours

TCBE 201: Entrepreneurship Skills

Duration: 30 Hours

Module Overview

The content for Term One introduces the learner to fundamentals of entrepreneurship that enable one to scan the environment for viable business opportunities. The learner will acquire entrepreneurial skills to turn challenges into opportunities by taking risks through planning, creativity and innovation.

Learning outcomes

By the end of this term, the learner should be able to:

- Appreciate and confidently practice entrepreneurship
- Conduct a feasibility study
- Mobilize resources and start up an enterprise

Competences

The learner:

- Differentiates entrepreneurship from ordinary business ventures
- Exhibits qualities of a good entrepreneur
- Practices entrepreneurial ethics
- Scans the environment for business opportunities
- Generates ideas for the business
- Selects a viable business idea
- Obtains rights to protect personal business.
- Portrays the characteristics of innovativeness and creativity
- Identifies forces of innovation
- Devises means of overcoming barriers to creative thinking
- Selects the most appropriate form of business enterprise to operate.
- Draws a simple business plan
- Prepares simple budget for the business
- Registers a business
- Mobilises resources for starting a business.
- Locates a business in a suitable environment

Detailed Module Description

Duration

Sub-module 1: Introduction to Entrepreneurship

03 Hours

- Meaning of entrepreneurship
- Qualities of an entrepreneur
- Entrepreneurial ethics

Sub-module Environmental Analysis

10 Hours

- Meaning of environment
- Scanning business environment
- Generating business ideas

Sub-module 2: Innovation and Creativity • Meaning of innovation and creativity • Characteristics of innovative persons • Forces of innovation • Barriers to creative thinking	04 Hours
Sub-module 3: Business Planning • Forms of small business ownership (sole proprietorship and partnership) • Uses of a business plan • Parts of a business plan • Writing a simple business plan • Developing a simple budget	09 Hours
Sub-module 4: Implementing a Business Plan • Registering a sole proprietorship and partnership • Mobilising business resources: - Financial resources - Human resources - Plant, Machinery and Equipment • Locating a business	04 Hours

TCCS 201: Basic Kiswahili

Duration: 20 Hours

Module Overview

This module introduces the learner to the basic Kiswahili used in the industries and by the general public to carry out daily business. It also enables the learner to carry out his/her profession in any part of East Africa where Kiswahili is the major language of communication.

Learning Outcome

By the end of the module, the learner should be able to seek for help and transact business in Kiswahili.

Competences

The learner:

- acknowledges the importance of learning and using Kiswahili language.
- greets peers, parents and supervisors in Kiswahili.
- names places and people in their capacities.
- appreciates others by saying 'thank you' and 'well-done' in Kiswahili.

Detailed Module Description

Duration

Sub-module 1: Introduction Kiswahili

02 Hours

- Origin and wide spread of Kiswahili
- Importance of Kiswahili to Ugandans and other East African countries

Sub-module 2: Polite Language

18 Hours

- Greetings to peers, age-mates, parents, elderly and supervisors
- Salutations at different times of the day
- Appreciation and saying 'thank you' for work done, gifts, food, etc.
- Asking for directions, assistance, food and so on.
- Names of places like schools, hospitals, markets, garages, roads, airports, water wells, forests, villages, towns, sites, hills
- Names of people and professional titles like technicians, nurses, messengers, watchmen, drivers, doctors, teachers, students

TCES 201: Electrical Installation Systems and Design

Duration: 30 Hours

Module Overview

The module introduces the learner to electrical installation systems and design which equips the learner with the skills of electrical drawing and interpretation of electrical and electronics circuits.

Learning Outcome

By the end of this module, the learner should be able to draw and interpret electrical and electronics circuits.

Competences

The learner:

- draws and interprets block diagrams, layout diagrams and single line high way diagrams.
- draws the schematic and equivalent circuits.
- draws servicing and manufacturing drawings.
- identifies needs from the client.
- interprets the needs of the client into electrical problem.
- develops the sketch of the layout according to the client's needs.
- models and develops the wiring diagram.
- designs the circuit.
- interprets electrical and electronic circuits.
- draws electrical and electronic circuits.
- Draws graphical symbols.
- uses graphical symbols on the layout drawing
- identifies different types of accessories in domestic, commercial and industrial wiring.
- Chooses quality materials to be used in a certain installation.

Detailed Module Description	Duration
Sub-module 1: Types of Diagrams • Block diagrams • Layout diagrams • Single line highway diagrams • Schematic and equivalent circuits • Servicing, manufacturing drawing	06 Hours
Sub-module 2: Introduction to Design • Needs identification • Design circuit • Design layout according to clients' needs (design brief and ideas) • Modelling, development and interpretation	04Hours
Sub-module 3: Circuit Construction using Component Symbols • Electrical circuits • Electronic circuits	10 Hours

Sub-module 4: General Specification • Specification for items of wiring system • Switches, fuses and circuit breakers • Conductors and their accessories • Energy meters	10 Hours
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TCES 202: Equipment Repair and Maintenance

Duration: 50 Hours

Module Overview

The module equips the learner with skills of marking out, soldering, repairing and maintaining electrical equipment.

Learning Outcomes

By the end of this module, the learner should be able to:

- use marking tools and cutting tools to fabrication MK box.
- use different methods of joining to fabricate a meter box.
- use drilling, grinding, welding, compressor, lathe machines
- maintain and repair electrical equipment.

Competences

The learner:

- describes maintenance.
- analyses the objectives of maintenance.
- compares functions and benefits of maintenance.
- identifies different types of maintenance.
- applies maintenance record keeping in maintenance process.
- identifies measuring equipments for bench work.
- marks out on the work pieces.
- uses hand tool to carry out different operations.
- identifies the various joining methods.
- Differentiates between soldering and brazing
- Weld, solder, braze and rivet work pieces/ appliances/ machines.
- observes safety precautions while carrying out joining methods in the workshop.
- Identify the application of workshop machines
- operates machines in the workshop.
- identifies different drill bits used in drilling machines.
- connects horse pipes to the gas cylinders.
- sets different gas levels.
- Troubleshoot workshop machines.
- observes safety precautions while using workshop machines.
- takes data.
- dismantles the motor.
- analyses faults in motors.
- tests for faults.
- removes winding.
- measures the gauge of the windings.
- purchases windings.
- replaces windings and assembling.
- tests the motor.

Detailed Module Description

Duration

Sub-module 1: Maintenance • Introduction (definition, objectives, functions, benefits) • Types of maintenance Maintenance record keeping	04 Hours
Sub-module 2: Marking Out • Measurement (essential measuring equipment for bench work) • Marking out (using scribe, chalk liner, straight, try square, spirit level, plumb bob)	8 Hours
Sub-module 3: Joining Methods • Soldering • Brazing • Welding • Riveting	8 Hours
Sub-module 4: Workshop Machines • Drilling machines • Grinding machines • Compressors	10 Hours
Sub-module 5: Motor Rewinding • Taking data • Testing and analysing faults in motors • Dismantling • Removal of windings • Measuring the gauge of the windings • Purchase of winding materials • Replacement of windings and assembling • Testing the repaired motor	20 Hours

TCES 203: Industrial Installation and Automation

Duration: 40 Hours

Module Overview

This module equips the learner with skills and techniques of designing control circuits.

Learning Outcomes

By the end of this module, the learner should be able to:

- designs and installs motor control circuits.

Competences

The learner:

- identifies different sequential circuit components.
- Identifies applications of sequential control.
- draws different sequential circuit symbols.
- differentiates between contacts (make, break).
- designs basic sequential circuits.
- wire basic sequential circuits.
- tests basic sequential circuits.
- Designs traffic lights.
- differentiates between the different motor control circuits.
- designs motor control circuits.
- wires and tests motor control circuits.
- Installs motor starters

Detailed Module Description

Duration

Sub-module 1: Introduction to Sequential Control

20 Hours

- Definitions, sequence, contacts
- Components, timers, relays, button switches, contactors
- On circuit, off circuit, ON and OFF relay circuit
- Flickering circuits

Sub-module 2: Motor Control Circuits

20 Hours

- Methods of controlling induction motors (direct on line starter, forward and reverse, automatic star delta starter)

TCES 204: Electrical Machines and Basic Electronics

Duration: 40 Hours

Module Overview

The module equips the learner with techniques of identifying types of motors and operating DC and AC motors.

Learning Outcome

By the end of this module, the learner should be able to operate electric machines.

Competences

The learner:

- describes the construction and operation of different types of electrical machines.
- identifies different types of electrical machine and their characteristics.
- computes back Electro Motive Force (EMF) power loss, efficiency, torque, motor speed and number of poles.
- identifies methods of reversing the rotation of DC motors.
- analyses the application of back EMF in DC motors.
- analyses the operation and application of a face plate starter.
- identifies different types of speed control.
- describes the construction and operation of single phase AC motors.
- identifies different types of single phase AC motors.
- compares different types of single phase AC motor characteristics.
- identifies different methods of starting single phase AC motors.
- describes the construction and operation of a three phase induction motor.
- analyses the production of a rotating magnetic field and torque.
- determines slip and its application in three phase induction motors.
- analyses rotor constants, current and copper loss.
- computes induction motor calculations.
- analyses torque equation and its application in three phase induction motors.
- identifies different types of three phase induction motors.
- compares different starting methods of induction motors.
- differentiates between cage and wound motors.

Detailed Module Description

Duration

Sub-module 1: DC Motors

14 Hours

- Construction
- Principles of operation
- Back EMF of a motor
- Types of DC motors and their characteristics
- Reverse of direction of relation of a DC motor
- DC face plate starter and its operation
- Types of speed control

Sub-module 2: Single Phase AC motors

10 Hours

- Construction
- Types of single phase AC motors and their characteristics

• Methods of starting single phase AC motors	
Sub-module 3: Three Phase AC Motors • The three phase induction motor • Construction • Production of a rotating magnetic field and torque • Slip • Rotor constants, current and copper loss • Induction motor calculations • Torque slip and torque speed characteristics • Torque equation • Maximum torque • Types of three phase induction motors • Starting of induction motors • Cage motors, wound rotors	16 Hours

TCES 105: Real Life Project I

Duration: 40 Hours

Module Overview

The module introduces the learner to the project work which equips him/her with the skills of designing, constructing and fabricating tangible item to suite the world of work.

Learning Outcomes

By the end of this module, the learner should be able to:

- Select suitable tools to be used
- Fabricate MK, meter box, welding machine container
- repairs and rewinds a motor/generator/transformers
- design and construct D.C power supply
- design and program traffic lights using PLC software

Competences

The learner:

- chooses the suitable tools to be used.
- fabricates MK boxes or meter boxes or welding machine container
- troubleshoots and diagnoses faults in machines.
- rewinds motors or generators or welding machines or transformers
- designs and installs starter on machines

• designs and programs traffic lights using PLC software • designs and constructs D.C power supply. • Observes safety when designing projects	
Detailed Module Description	Duration
Proposed projects to choose from An institution/instructor concerned and learners may choose and do any one project listed below in term 1, term 2 or term 3 A minimum of one project and a maximum of three projects may be carried in year one. Any project done should be a reality and should be done as expected in the world of work. Health, environment, safety and security (HESS) should be highly upheld by the institution, instructor concerned and learners before, during and after project execution. 1. Fabricate MK boxes or meter boxes or welding machine container 2. Rewind motors or generators or welding machines or transformers 3. Design and install starter on machines 4. Design and program traffic lights using PLC software 5. Design and construct D.C power supply	40 Hours

Detailed Module Description of Year 2 Term 2

TCTM 201: Applied Technician Mathematics II	
Duration: 40 Hours	
Module Overview Introduces the learner to engineering calculus used in determining the estimated loads that the structure is expected to carry.	
Learning Outcome By the end of this module, the learner should be able to apply calculus in determining the bending moments of beams and other structures.	
Competences The learner: • differentiates the variables from first principle. • differentiates the product and quotient. • applies differential equations in determining beam deflections. • applies integral equations to evaluate the extent of beam deflections. • determines gradient of a curve. • uses integration principle to determine the size and area of a simple structure. • adds fractions to get a common denominator. • manipulates functions in rules. • applies inverse of a function. • draws graphs.	
Detailed Module Description	Duration
Sub-module 4: Differentiation • Differentiation from first principle • Differentiation of product and quotient • Choice of variable	14 Hours
Sub-module 5: Integration - Single and Double Integrals • Standard Integrals • Functions of linear function of 'x' • Integration of polynomial functions • Integration by partial fractions • Areas under curves	16 Hours
Sub-module 6: Elementary Functions • Functions in rules • Functions and the arithmetic functions • Inverse of function and graphs	10 Hours

TCBE 201: Entrepreneurship Skills

Duration: 30 Hours

Module Overview

This term's content is intended to equip the learner with knowledge, competences and skills to start up and successfully manage a small business. The learner will be trained on how to implement the business plan designed in Term One, produce goods/services for sale, market the products, and manage financial and human resources of the business.

Learning Outcomes

By the end of this term, the learner should be able to:

- Produce quality goods and services
- Enhance competitiveness of the product through market survey
- Competently manage business finances
- Correctly guide and control the business work force
-

Competences

The learner:

- Determines the cost of production
- Designs appropriate packaging for the product
- Adds value to the product
- Carries out a market survey
- Applies the 4Ps in marketing a product
- Promotes the products for sale
- Maintains basic business records
- Computes business profits/losses
- Prepares simple income statements, Balance sheet and cash flow statements
- Orients employees on business issues
- Maintains a motivated workforce
- Appraises staff
- Incorporates a compensation policy for the employees.
- Shares responsibilities with employees
- Recognizes the contribution of workmates.
- Identifies causes of conflicts in small enterprises
- Resolves conflicts at the work place

Detailed Module Description

Duration

Sub-module 6: Production

06 Hours

- Costing production
- Packaging (protection, handling, preservation and presentation of a product)
- Value addition

Sub-module 7: Marketing • Market survey • Marketing mix {Price, Place, People, Product (4Ps)} • Sales promotion	06 Hours
Sub-module 8: Financial Management • Bookkeeping (Recording transactions, Source documents, Journals, Balancing accounts, Trial balance, Bank reconciliation, Simple Income statement, Simple balance sheet) • Simple Cash flows	12 Hours
Sub-module 9: Resource Management • Orientation • Importance of motivation • Performance appraisal • Compensation in compliance with labour laws • Need for delegation and challenges encountered • Importance of teamwork • Settling conflicts at workplace	06 Hours

TCCS 201: Basic Kiswahili

Duration: 20 Hours

Module Overview

This module introduces the learner to the basic Kiswahili used in industries and by the general public to carry out daily business.

Learning Outcome

By the end of the module, the learner should be able to transact business in Kiswahili.

Competences

The learner:

- counts numbers 0-1000000 in Kiswahili.
- identifies and names the parts of the human body in Kiswahili.
- names domestic animals, birds and insects in Kiswahili.
- mentions the days of the week, names the months of the year and tells the true dates.

Detailed Module Description

Duration

Sub-module 3: Comprehension

10 Hours

- Vowels a e i o u
- Consonants b, ch, d, dh, f, g, gh, h, j, k, l, m, n, ng, ny, p, r, s, sh, t, th, v, w, y, z.
- Counting and numbers 0-9, 10- 1000000
- Daily and common activities and sayings; welcome, have a seat, thank you, wish you well, sorry
- Parts of the human body like head, legs, etc.

Sub-module 4: General Vocabulary

10 Hours

- Names of domestic animals like goats, sheep, cows, pigs, rabbits, dogs, cats
- Names of domestic birds like ducks, turkeys, hens
- Names of insects like mosquitoes, flies, cockroaches
- Months in a year, days of the week, dates and telling time
- Names of objects like doors, windows
- Common usage of Kiswahili; home and garden activities
- Common mistakes to be avoided

TCES 201: Electrical Installation Systems and Design

Duration: 30 Hours

Module Overview

The module equips the learner with skills and techniques of management and of developing bills of quantities from electrical installation systems, maintenance plans and managing sites.

Learning Outcome

By the end of this module, the learner should be able

- Design given plans
- Calculate sizes of cable
- Use the suitable lighting systems

Competences

The learner:

- applies diversity factor during cable size calculation.
- applies the correct procedure for cable size selection.
- identifies factors to be considered during cable selections.
- distinguishes between different installation methods of cables.
- uses IEE regulation tables to determine current carrying capacity of cables.
- calculates the cable size to be used in electrical work.
- Describe different lamps
- Connect different lamps in the circuit
- identifies regulations regarding different types of lamps.
- minimises stroboscopic effect.
- plans and designs an installation according to the IEE wiring regulations.
- excavates and lay underground cables.
- draws plans of overhead and service lines.
- gives provisions of earthing on the drawings.

Detailed Module Description	Duration
Sub-module 5: Cable Size Calculation/Selection • Application of diversity factor • Procedure for selecting cable size • Factors considered when selecting cable size • Installation methods of cables • Current carrying capacity of conductors as tabulated in IEE regulations	10 Hours
Sub-module 5: Lighting Systems • Filament lamps • Discharge lamps: (fluorescent, high pressure, mercury vapour, sodium vapour, and tungsten halogen lamps). • Regulations regarding discharge lamps • Stroboscopic effect	10 hours

• Operation of fluorescent fitting on DC supply	
Sub-module 6: Planning and Designing • IEE wiring regulations latest edition • Lighting, wiring layout and power circuits • Underground cable runs • Trenches, conduits, trunking and ducts • Overhead lines • Service lines • Transmission and distribution • Earthing • Feeders and sub-stations	10 Hours

TCES 202: Equipment Repair and Maintenance

Duration: 50 Hours

Module Overview

The module equips the learner with skills of fabricating, using, maintaining and repairing electrical equipments.

Learning Outcome

By the end of this module, the learner should be able to fabricate, maintain and repair electrical equipment.

Competences

The learner:

- identifies faults in domestic appliances.
- dismantles electrical appliances.
- tests for: continuity, polarity, insulation resistance and effectiveness of earthing.
- repairs an electrical appliance.
- assembles electrical appliances.
- identifies different types of welding machines.
- identifies the correct materials for building welding machines.
- repairs and maintains welding machines.
- dismantles welding machine.
- identifies tools required for assembling and dismantling a welding machine.
- determines the turns ratio of windings.
- sizes, cut laminations and rewind
- fabricates the container for welding machine.
- identifies the transformer oil.
- assembles a welding machine
- identifies different types of battery chargers.
- identifies suitable materials for building battery chargers.
- determines the voltage turns ratio.
- dismantles the battery charger.
- identifies tools required for assembling and dismantling battery charger.
- sizes, cuts laminations and rewinds.
- fabricates the case and labels terminals.
- tests the battery charger.
- assembles the battery charger.

Detailed Module Description

Duration

Sub-module 6: Domestic Appliances

20 Hours

- Fans
- Washing machines
- Flat irons
- Kettles
- Cookers

Sub-module 7: Welding Machines

15 Hours

• Types of welding machines • Materials for building a welding machine • Voltage turn ratio • Sizing, cutting lamination and rewinding • Fabricating the container • Importance of transformer oil	
Sub-module 8: Battery Chargers • Types of battery chargers • Materials for building battery chargers • Voltage turn ratio • Sizing, cutting lamination and rewinding • Fabricating the case and labelling the terminals	15 Hours

TCES 203: Industrial Installation and Automation

Duration: 40 Hours

Module Overview

The module equips the learner with skills and techniques of designing and configuring control circuits.

Learning Outcome

By the end of this module, the learner should be able to program and install control circuits using PLC software.

Competences

The learner:

- identifies different pneumatic components.
- Describes PLC
- differentiates between the different types of PLCs.
- transforms a sequential control circuit into a PLC program.
- connects PLC with external devices.
- designs control program using PLC software.
- troubleshoot control circuits.
- connects inputs and outputs to PLC.
- configures PLC.
- uses basic commands to programme.

Detailed Module Description	Duration
Sub-module 3: Introduction to Pneumatics • Solenoids • Limit switches • Servo and stepper motors • Pneumatic cylinders • Types of sensors	15 Hours
Sub-module 4: Programmable Logical Controller (PLC) • Types of PLC • Input and output units • PLC configuration • Basic commands • Introduction to automated control systems such as factories and buildings	25 Hours

TCES 204: Electrical Machines and Basic Electronics

Duration: 40 Hours

Module Overview

The module introduces learners to AC generators, transformer and synchronous motors which equips them with skills and techniques of working on machines.

Learning Outcome

By the end of this module, the learner should be able to operate and repair an electric machine.

Competences

The learner:

- describes the construction and operation of a three phase AC generator.
- analyses excitation supply and its function in an AC generator
- identifies the relationships between number of pole pairs, speed and frequency.
- compares synchronous generator characteristics.
- differentiates between open and short circuit tests of a three phase AC generator.
- analyses the term regulation in a three phase AC generator.
- analyses and compares the generator load characteristics.
- identifies different types of transformers
- analyses the construction and operation of the transformer.
- compares the transformer on no-load and on load.
- identifies examples of transformer on load.
- analyses transformer impedance and referred values.
- identifies different types of transformer losses.
- appreciates and uses values of transformer efficiency tests.
- computes transformer efficiency.
- analyses transformer terminal marking and how it is carried out in transformers.
- compares auto transformer and the instrument transformer.
- describes the operation and construction of synchronous motor.
- identifies starting methods of synchronous motors.
- compares methods of synchronisation.
- analyses synchronous motor phasor diagrams.
- operates a synchronous motor with fixed excitation and at constant power.

Detailed Module Description	Duration
Sub-module 4: The Three Phase AC Generators • Construction • Excitation supply • Relationship between number of poles, speed and frequency • Synchronous generator characteristics • The open and short circuit tests • Regulations • Load characteristics	12 Hours
Sub-module 5: Transformers	14 Hours

• Types of transformers • Basic principles of operation of a transformer and its construction • Transformer on load and no load • Examples of a transformer on load • Transformer impedance and referred value • Voltage regulation • Transformer losses • Transformer tests • Transformer efficiency • Terminal marking • The auto transformer and instrument transformer	
Sub-module 6: Synchronous Motors • Synchronous motor principles • Starting a synchronous motor • Synchronisation and method of synchronisation • Synchronous motor phasor diagram • Operating a synchronous motor with fixed excitation and at constant power	14 Hours

TCES 105: Real Life Project I

Duration: 40 Hours

Module Overview

The module introduces the learner to the project work which equips him/her with the skills of designing, constructing and fabricating tangible item to suite the world of work.

Learning Outcomes

By the end of this module, the learner should be able to:

- Select suitable tools to be used
- Fabricate MK, meter box, welding machine container
- repairs and rewinds a motor/generator/transformers
- design and construct D.C power supply
- design and program traffic lights using PLC software

Competences

The learner:

- chooses the suitable tools to be used.
- fabricates MK boxes or meter boxes or welding machine container
- troubleshoots and diagnoses faults in machines.
- rewinds motors or generators or welding machines or transformers
- designs and installs starter on machines
- designs and programs traffic lights using PLC software
- designs and constructs D.C power supply.
- Observes safety when designing projects

Detailed Module Description

Proposed projects to choose from

An institution/instructor concerned and learners may choose and do any one project listed below in term 1, term 2 or term 3

A minimum of one project and a maximum of three projects may be carried in year one.

Any project done should be a reality and should be done as expected in the world of work.

Health, environment, safety and security (HESS) should be highly upheld by the institution, instructor concerned and learners before, during and after project execution.

6. Fabricate MK boxes or meter boxes or welding machine container
7. Rewind motors or generators or welding machines or transformers
8. Design and install starter on machines
9. Design and program traffic lights using PLC software
10. Design and construct D.C power supply

Duration

40Hours

Detailed Module Description of Year 2 Term 3

TCTM 202: Applied Technician Mathematics II	
Duration: 32 Hours	
Module Overview The module introduces concepts of set theory as may be applied in mixing ratios and basic statistics used in recording of day's work and site progress. The knowledge attained in this module also enables the learner to tally any collected data for a particular purpose, leading to making a realistic and informed decision.	
Learning Outcomes By the end of this module, the learner should be able to: • apply the set theory in batching roofing materials. • apply the skills of illustrating histograms in drawing the industrial operation programme.	
Competences The learner: • identifies and groups elements of a set. • analyses the difference between union of sets, sub-sets and intersection of sets. • applies set theory in grouping building materials. • analyses the relationship between set theory with that of ratios and proportions of building materials. • records information on frequency distribution sheet. • determines the average of a given data. • draws histograms representing given information. • applies the mean arithmetic in analysing the site activities for monthly salary and overtime allowances of workers. • applies the assumed mean for calculating standard deviation of materials costs in the market.	
Detailed Module Description	Duration
Sub-module 7: Theory of Sets • Elements of sets • Union of sets • Intersection of set	18 Hours
Sub-module 8 : Basic Statistics • Recording information and frequency distribution • Types of average • Histograms • Calculating mean, standard deviation and assumed mean	14 Hours

TCBE 201: Entrepreneurship Skills

Duration: 24 Hours

Module Overview

The content for this term introduces learners to regular business support services to enable successful sourcing for funds to boost the business, manage risks and follow best practices in the industry. It will equip learners with skills to manage contracts, lobby for financial services, insure business, and adhere to tax requirements.

Learning Outcomes

By the end of the module, the learner should be able to:

- Execute a contract economically and efficiently.
- Save and invest in the business.
- Insure the business.
- Pay taxes.

Competences

The learner:

- looks for contract information
- fills and prepares a simple bid document
- complies with the contract requirements
- opens and manages a bank account
- acquires and services a loan
- selects the most appropriate insurance policy for the business and their lives.
- observes the insurance principles
- manages the challenges encountered in insurance
- seeks for compensation when loss is suffered
- recognizes the importance of paying taxes
- identifies the taxes paid by small businesses
- calculates the tax payable
- files tax returns

Detailed Module Description	Duration
Sub-module 10: Contracting Process • Sources of contract information • Bid preparation • Contract execution and compliance	06 Hours
Sub-module 11: Banking • Services offered by commercial banks, microfinance institutions and SACCOs • Types of accounts (savings, current and fixed deposit) • Acquiring and servicing loans	06 Hours

Sub-module 12: Insurance for Small Businesses • Life assurance and property insurance • Principles of insurance • Process of getting compensation	6 Hours
Sub-module 13: Taxation • Reasons for paying taxes • Common taxes paid by small businesses - Local service tax - Property tax - Value added tax (VAT) - Income tax - Market dues - Ground rent - Trade licence • Calculating VAT and income tax payable • Filing tax returns	6 Hours

TCCS 201: Basic Kiswahili

Duration: 16 Hours

Module Overview

This module equips the learner with the professional use of Kiswahili in engineering works execution and management. It helps the learner give instructions to teammates or workmates who may not be familiar with the English language.

Learning Outcome

By the end of the module, the learner should be able to:

- name the tools, equipment and materials used in engineering .
- outline the titles of the personnel involved in carrying out engineering works
- use basic Kiswahili in the day

Competences

The learner:

- identifies and names the tools and equipment and states their uses in Kiswahili.
- differentiates the responsibilities and tasks performed by technicians in Kiswahili.
- identifies and names the materials used in engineering.
- develops good attitude towards work, customers and the general public.
- welcomes and handles customers with care and willingness in Kiswahili.
- advertises the product in Kiswahili.

Detailed Module Description

Duration

Sub-module 5: Specific Trade (professional related) Vocabulary

6 Hours

- Names of tools and equipment used by a technician
- Tasks performed by a technician
- Titles of officers in engineering
- Names of materials used in engineering

Sub-module 6: Customer Care and Language

10 Hours

- Attitude to customers, public and the job
- Public relations and persuasive business language
- Advertising products
- Handling customers: welcoming them, asking whether they need help, and thanking them

TCES 201: Electrical Installation Systems and Design

Duration: 24 Hours

Module Overview

The module equips the learner with the skills of developing bills of quantities from electrical installation plans and manages sites.

Learning Outcome

By the end of this module, the learner should be able to develop bills of quantities from electrical installation plans and manage sites.

Competences

The learner:

- selects appropriate method for market survey and source selection.
- estimates quantities of materials for site installations by determining both horizontal and vertical runs.
- makes bills of quantities.
- makes electrical schedules.
- identifies different price catalogues.
- determines the cost of materials and labour.
- manages electrical projects.
- identifies and differentiates between different types of organisation structures.
- applies management functions to manage project managements.
- applies project management on the electrical site.
- ensures quality management on projects.
- ensures that materials are controlled and managed in a systematic manner.

Detailed Module Description

Duration

Sub-module 7: Estimation of Quantities for Residential, Commercial and Industrial Installations

12 Hours

- Purpose of estimating and costing
- Electrical schedule
- Price catalogues
- Estimating quantities of materials for site installations
- Market survey and source selection
- Schematic and wiring diagrams
- Contingencies and overheads
- Determination of cost materials and labour

Sub-module 8: Management

12Hours

- Types of organisation structures
- Management functions
- Project management (site management and gant charts, critical path analysis, project control, monitoring and evaluation, types of contracting and variation)
- Quality management (quality control)
- Material control and management

TCES 202: Equipment Repair and Maintenance

Duration: 40 Hours

Module Overview

The module provides the learner with basic skills of installing air conditioning and repair of a cooling system.

Learning Outcome

By the end of this module, the learner should be able to install and repair a cooling system.

Competences

The learner:

- Describe the principles of refrigeration
- identifies various cooling systems (refrigeration).
- identifies components of the refrigeration system.
- describes the refrigeration cycle.
- troubleshoot and repairs the cooling system (refrigeration).
- identifies types of air conditioners.
- identifies basic components of an air conditioner.
- describes the principle of operation of an air conditioner.
- installs air conditioners.
- troubleshoots and repairs air conditioners.

Detailed Module Description

Duration

Sub-module 9: Refrigeration

20 Hours

- Principles of refrigeration
- Basic component parts
- Types of refrigeration systems
- Troubleshooting and repair

Sub-module 10: Air Conditioning

20 Hours

- Principles of operation
- Basic components
- Types of air conditioners
- Installation of air conditioners
- Troubleshooting and repairs

TCES 203: Industrial Installation and Automation

Duration: 32 Hours

Module Overview

This module equips the learner with the skills of carrying out and maintaining industrial installations.

Learning Outcomes

By the end of this module, the learner should be able to:

- carry out installation in the hazardous areas.
- wire an industrial installation.
- install a motor in a particular place/industry.

Competences

The learner:

- identifies the correct installation system in a particular hazardous area.
- identifies different potential danger areas.
- installs hospitals.
- installs petrol stations
- protects installation against corrosion, cathode protection
- carries temporary installation.
- installs farm and horticultural.
- Carries out installations high temperature places
- carries out inspection and testing according to IEE regulations.
- installs and maintains motors
- uses and protects motors according to IEE regulations.
- select the correct type of motor and control gear.
- choose the right method of starting the motor.
- carries out insulation resistance and continuity tests on the motor.
- troubleshoot, repair and maintain motors.
- prepares site and installs transformers.
- maintains transformers.
- cools the windings of a transformer.
- earths all the metallic parts of a transformer.

Detailed Module Description

Duration

Sub- module 6: Installation in Hazardous Areas

12 Hours

- Wiring system
- Potential danger areas
- Installation in hospitals
- Installation in petrol stations
- Corrosive atmosphere (protection against corrosion; cathode protection)
- Temporary installation
- Farm and horticultural installations
- High temperature installations
- Inspection and testing

• IEE regulations	
Sub-module 7: Motor Installation • Installation and mounting of motors (mounting, coupling, connecting) • Safe use and protection of motors (IEE regulations) • Motor final circuit equipment layout • Selection of motor and control gear • Methods of starting the motors • Maintenance of motors • Testing of motors (insulation resistance test) • Troubleshooting	10 Hours
Sub-module 8: Transformer Installation • Introduction • Site preparation • Mounting mode (pole mounted, ground mounted) • Methods of cooling • Earthing of the transformer	10 Hours

TCES 204: Electrical Machines and Basic Electronics

Duration: 32 Hours

Module Overview

The module equips the learner with skills of building and repairing simple electronic circuits.

Learning Outcome

By the end of this module, the learner should be able to build and repair simple electronic circuits.

Competences

The learner:

- relates the importance of electronics to the modern trend.
- applies both digital and analogue electronics in the modern world.
- Describe semi-conductors including its properties.
- Illustrate the formation of P- type and N- type semi-conductors.
- identifies different types of components used in electronic circuits.
- carries out resistance measurement and interprets resistance colour coding.
- tests diodes to determine the resistance of the diode in both forward and reverse directions.
- tests transistors.
- selects a step down transformer
- measures primary and secondary windings.
- identifies the application of half wave and full wave rectifiers and their differences.
- connects a transistor as an amplifier in three configurations (Common base, emitter and collector).
- sets the operating point of a transistor as an amplifier.
- constructs multi stage amplifiers.
- compares the difference between analogue and digital electronics.
- identifies basic logic gates.
- makes truth tables.
- develops logic gates circuits.

Detailed Module Description	Duration
Sub-module 7: Introduction to Electronics • Importance of electronics • Branches of electronics	02 Hours
Sub-module 8: Semi-conductors • Definition of semi-conductors • Properties of semi-conductors • Formation of P-type and N-type semi-conductors	02 Hours
Sub- module 9: Electronic Components • Resistors, capacitors, thyristors, diodes, transistors • Resistance measurement and colour codes • Diode and transistor testing	04 Hours
Sub-module 10: DC Power Supplies • Unregulated power supplies	10 Hours

• Step down transformer for power supplies • Single phase bridge rectifier and half wave rectifiers • Centre tapped rectifiers • Three phase rectifiers • Introduction to switching and linear regulators • Application of DC power supplies	
Sub-module 11: Amplifier Circuits • Transistors configuration • Methods of transistor biasing • Classes of amplifier and their application • Multi-stage amplifiers • Methods of coupling amplifier • Operational amplifiers	10 Hours
Sub-module 12: Introduction to Digital Electronics • Comparison between analogue and digital electronics • Types of analogue and digital systems i.e. radios, televisions, watches, metering systems, clocks, phones, automated teller machines (ATMs), car systems, etc. • Basic logic gates and their truth table (NOT, AND, OR, NAND, NOR)	4 Hours

TCES 105: Real Life Project I

Duration: 32 Hours

Module Overview

The module introduces the learner to the project work which equips him/her with the skills of designing, constructing and fabricating tangible item to suite the world of work.

Learning Outcomes

By the end of this module, the learner should be able to:

- Select suitable tools to be used
- Fabricate MK, meter box, welding machine container
- repairs and rewinds a motor/generator/transformers
- design and construct D.C power supply
- design and program traffic lights using PLC software

Competences

The learner:

- chooses the suitable tools to be used.
- fabricates MK boxes or meter boxes or welding machine container
- troubleshoots and diagnoses faults in machines.
- rewinds motors or generators or welding machines or transformers
- designs and installs starter on machines
- designs and programs traffic lights using PLC software
- designs and constructs D.C power supply.
- Observes safety when designing projects

Detailed Module Description

Proposed projects to choose from

An institution/instructor concerned and learners may choose and do any one project listed below in term 1, term 2 or term 3

A minimum of one project and a maximum of three projects may be carried in year one.

Any project done should be a reality and should be done as expected in the world of work.

Health, environment, safety and security (HESS) should be highly upheld by the institution, instructor concerned and learners before, during and after project execution.

- Fabricate MK boxes or meter boxes or welding machine container
- Rewind motors or generators or welding machines or transformers
- Repair of domestic appliance such kettles, refrigerators, blenders, toasters
- Design and install starter on machines
- Design and program traffic lights using PLC software
- Design and construct D.C power supply

Duration

32 Hours

TCES 206: Industrial Training II

Duration: 288 Hours

Module Overview

The module equips the learner with on-job hands-on practical training in Electricity Supply Industrial (ESI).

Learning Outcomes

By the end of this module, the learner should be able to:

- explain electricity supply in industries.
- work on consumer installations.
- fault find and diagnose.
- install, test, inspect and commission electrical installations.

Competences

The learner:

- diagnoses and rectifies electrical faults.
- installs and repairs electrical equipment.
- writes a report.

Detailed Module Description

Duration

Sub-module1: Industrial Training

288 Hours

- Acquaintance of industry
- Familiarisation with equipment and tools
- Acquisition of skills of repair and maintenance and installation of electrical equipment

Appendices

Appendix 1: Industrial Training Guidelines

The guidelines below should be followed during Industrial Training:

- i) It starts at the end of the 3rd Term
- ii) It takes a minimum period of 6 weeks
- iii) It is carried out at the world of work located in any part of Uganda including the training institutions
- iv) The training institution has the duty of budgeting for Industrial Training, obtaining money from government for government sponsored learners, explaining to the learners what they are expected to do, finding placements for learners, posting the learners, supervising and assessing learners during the training.

Supervision

- i) There should be a world of work or field or industry supervisor and an academic supervisor from the training institution.
- ii) The academic supervisor visits the learner at least once. During these visits, she/he interacts with the learner, field supervisor and visits the attachment site or workplace as she/he carries out the assessment.

Assessment

Marks for assessment should be divided into three as follows:

- i) Assessment by field supervisor 50%
- ii) Assessment by academic supervisor 30%
- iii) Field attachment report 20%

All the above assessment must be carried out for one to pass Industrial Training and be considered competent to some level.

Note: The institutions should submit the list of industrial placements for the candidates with contacts in order for the examination board to carry out its external supervision and verification.

Appendix ii: Industrial Training Assessment Form for Field or Onsite Supervisor

Name of institution.				
Name of industry.				
Name of student.				Signature.
Registration.				
Name of supervisor.				Signature.
Date.				
	Area of Assessment	Marks	Score	Area of Improvement
A	Attendance (% age of days and times within the days present)	5		
B	Work Performance involvement	35		
	1. Co-operation with other staff	5		
	2. Ability to communicate effectively	5		
	3. General ability to use various equipment, machines or plant in the industry	10		
	4. Flexibility-willingness to learn from various sections in industry	7		
	5. Job planning	8		
C	Initiative and Innovation	15		
	1. Problem-solving	8		
	2. New ideas on improvement for efficiency of performance or operations	7		
D	Time Management	5		
	1. Reporting on time	1		
	2. Leaving at specified break-off or stoppage time	1		
	3. Meeting deadlines on assignments given by supervisors or instructors	3		
E	Discipline and Safety Observation	15		
	1. Use of right equipment for right job	4		
	2. Obeying instructions	4		
	3. Proper handling of	2		

	equipment and or materials			
	4. Ability to practice safety measures in the workplace	3		
	5. Knowledge of first aid procedures in case of accident	2		
F	Practical Skills	20		
	1. Ability to put into practice training instructions from instructors or supervisors	4		
	2. Ability to relate theoretical knowledge with practical applications	4		
	3. Proper use of manuals and interpretation of drawings	4		
	4. Ability to carry out trouble shooting on equipment, (put right mistake in work or finishing)	4		
	5. Ability to service and repair equipment (clean and maintain tools and workplace)	4		
G	General Remarks (other assessment at discretion of assessor)	5		

The assessment shall be carried out as indicated in each area and then the total mark obtained is computed to 50%.

Appendix iii: Industrial Training Assessment Form for Academic

Name of Institution.....				
Name of Industry				
Name of student			Signature.....	
Registration Number				
Name of supervisor			Signature	
Date				
	Area of Assessment	Marks	Score	Area of Improvement
A	Attendance (Was the learner at his work place?)	5		
B	Understanding of tasks	21		
	1. Did the learner provide weekly summary of work performed?	2		
	2. How did the learner describe the tasks performed?	4		
	3. How was the learner able to explain why tasks were being done in a particular way?	3		
	4. How did the learner explain problems experienced when carrying out the work and how they were solved?	3		
	5. How did the learner explain the knowledge and skills acquired at the institute that enabled him to perform?	2		
	6. How did the learner describe the new knowledge and skills gained?	3		
	7. How did the learner explain his relationship with his core workers and supervisors and how he plans to improve or maintain it?	2		
	8. How did the learner relate the industrial training tasks to his training as a technician?	2		
C	General Remarks (Other assessment at discretion of examiner)	4		
Total mark		30		

The assessment shall be carried out as indicated in each area and then the total mark obtained is computed to 30%.

Appendix IV: Field Attachment Report and Guide for Industrial Training

The report should be written in English and contain the following to be assessed as shown:

No	Contents	Maximum Score
1	Cover page: i) Name of institution ii) Name of Department iii) Name of learner and year of study iv) Place of Industrial Training v) Period of Industrial Training e.g. July- September 2015 vi) Academic and Field Supervisor's signatures	1 mark
2	Acknowledgements i) Acknowledge all assistance during field training ii) Acknowledge assistance during report writing	0.5 marks
3	Executive summary or abstract i) To include statement of the most practical work carried out ii) Challenges iii) Conclusions	2 marks
4	Table of contents To show the content of the report and page numbers where they first occur	0.5 marks
5	List of figures i) All figures in the report must have a number and a caption ii) Figures must be numbered according to the chapters where they occur for example; Figure 4.1, to refer to first Figure in chapter 4 iii) The pages where the figures occur must be shown in the list of figures	0.5 marks
6	List of tables i) All tables in the report must have a number and a header ii) Tables must be numbered according to the chapters where they occur for example; Table 2.1, to refer to first table in Chapter 2 iii) The pages where the tables occur must be shown in the list of tables	0.5 marks
7	List of acronyms or abbreviations Acronyms used should be given in alphabetical order with their full meaning shown	0.5 marks

8	Introduction i) Location and description of place of field attachment ii) Objectives of field attachment iii) Structure, organisation iv) Tasks carried out by the place attached to e.g. if District Local Government describe its role in society	2 Marks
9	Main body of the report i) Description of work carried out ii) Duties and responsibilities assigned and how they were carried out iii) Health, safety and security regulations observed during execution of activities iv) New knowledge and skills gained v) Relationship with other staff and supervisor vi) Problems experienced and how they were handled	8 marks
10	Conclusions A brief summary of knowledge gained as outlined in the objectives	1mark
11	Recommendations i) For improving Industrial Training, usually derived from problems experienced ii) For improvement of work output at the place of work (this is included if allowed by the field supervisor)	1.5 marks
12	References i) Design standards and guidelines used during training ii) Books and internet material iii) APA style of referencing shall be used.	1.5 marks
13	Appendices i) Drawings ii) Photographs, etc	0.5 marks
Total Mark		20 marks

Appendix 5: Tools and Equipment for the Institution

- Air conditioners
- Allen keys
- Batteries
- Beamer project
- Blind man's cane
- Blindfolds
- Bread boards
- Combination types
- Computer tables and chairs
- Consumables for the plotters and printers
- Crimping tools
- Desktop computers
- Digital cameras
- Digital conductivity and TDS meter
- Digital multi-meter
- Digital oxygen analyser
- Digital pH meters
- Digital water analysers
- Drawing instruments
- Electrical tool kit
- Electronic calculator
- Files
- French curves
- Hacksaws
- Hammers
- Heavy duty laser printer
- Insulation resistance tester
- Landfill/composite temperature probe
- Laser plan plotter
- LDC projector, laser pointer
- Mallet hammer
- Measuring instruments (wattmeter, voltmeters etc)
- Motors
- Pairs of pliers such as long-nosed
- Pocket knife
- Power drilling machine
- Programmable logic controllers
- Safety gears
- Scientific calculator
- Screw drivers – both flat head and star
- Sequential boards
- Set of drawing instruments
- Side cutters
- Solar PV equipment
- Soldering iron
- Standards for the specialised area such as the IEE electrical wiring regulations
- Tape measures
- Televisions
- Transformers
- Turbidity meter kit, 230V/50Hz
- UPS
- Vero boards
- White folding screens
- Wires stripper
- Wiring boards

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