NCDC
NATIONAL CURRICULUM DEVELOPMENT CENTRE

National Certificate in AUTOMOTIVE MECHANICS

Teacher's Guide to the Syllabus *for* Technical and Vocational Institutions

THE REPUBLIC OF UGANDA
Ministry of Education and Sports

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DEVELOPMENT CENTRE

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Teacher's Guide to the Syllabus
for
Technical and Vocational Institutions

THE REPUBLIC OF UGANDA
Ministry of Education and Sports

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Grace. K. Baguma
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Foreword

Improvement of the curricula for Technical Certificate Courses is part of the Ministry of Education and Sports (MoES) Strategy (2008) for the provision of Technical and Vocational Education. Technical and Vocational Institutes are the institutions producing technicians in the country. 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".

This curriculum is learner-centred and competence-based, updated bearing in mind current labour market demands. 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.

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 Automotive Mechanics perform. This led to the development of all modules in this curriculum.

This curriculum aims at making Technical and Vocational Institutions the centre of excellence for technical education and skills development in the region, which will lead to a greater development and industrialisation of the country.

Hon Janet Kataaha Museveni
MINISTER OF EDUCATION AND SPORTS

List of Acronyms

ABC	Abstain, Be faithful, Use Condoms
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 Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome
KES	Kyambogo Engineering Service
LCM	Lowest Common Multiple
MoES	Ministry of Education and Sports
MoH	Ministry of Health
MoGLSD	Ministry of, Gender, Labour and Social Development
NCAM	National Certificate in Automotive Mechanics
NCDC	National Curriculum Development Centre
NCHE	National Council for Higher Education
NCMF	National Certificate in Machining and Fitting
NDME	National Diploma in Mechanical 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
PLHIV	People Living with HIV and AIDS
PP	Probationary Progress

PPDA	Public Procurement and Disposal of Assets
RTI	Research Triangle International
SACCO	Savings 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 and AIDS
STI's	Sexually Transmitted Infections
TC	Technical Certificate; module code letter identifiers for Certificate Courses
TCTM	Technical Certificate Course module code for Applied Technicians Mathematics
TCCS	Technical Certificate Course module code for Communication Skills
TCCA	Technical Certificate Course module code for Computer Applications
TCBE	Technical Certificate Course module code for Business Entrepreneurship Skills
TCHY	Total Contact Hours per Year
TCMF	Technical Certificate Course module code for Machining and Fitting core modules
TCAM	Technical Certificate Course module code for Automotive Mechanics core modules
TH	Training Hours
TS	Technical School
TI	Technical Institute
UBTEB	Uganda Business and Technical Examinations Board
UNAIDS	United Nations Programme on HIV and AIDS
UNEB	Uganda National Examinations Board
UTC	Uganda Technical College
VAT	Value Added Tax
VTI	Vocational Training Institute
VS	Vocational School
WoW	World of Work

Introduction

This Teacher's Guide is aimed at equipping the teacher with learner-centred methods of conducting training sessions here referred to as teaching and learning strategies, by ensuring that the learners gain the desired competences. You should therefore ensure that the learners fully participate in the lesson administration.

This guide emphasises practical teaching, projects and acquisition of skills by the learner. The competences that learners are expected to acquire are clearly spelt out in each module covered in the term. You should ensure that learners are well versed with practical work.

The teaching methodologies developed in this guide if implemented effectively, will produce Motor Vehicle craftsmen who are able to:

i) fabricate simple parts.
ii) maintain and repair engines to good working condition.
iii) maintain the transmission and suspension systems of the vehicle.
iv) install, repair and maintain the electrical/electronic systems of the vehicle.
v) ensure the safety of personnel and the vehicle.
vi) prepare reports, budgets, and operation plans.

You should therefore try as much as possible to guide learners to acquire these competences during the course of study.

Rationale of the Teacher's Guide

This Teacher's Guide is meant to facilitate you to effectively interpret and use the Syllabus to deliver more updated and relevant content to the learners. It outlines the methods you may use, the procedures to be taken, and the assessment and evaluation techniques. It is an essential tool kit in the success of the teaching and learning process of the NCAM.

Components of the Teacher's Guide

This Teacher's Guide is composed of the following:

Module: This is the subject of study in the specified duration. It has particular competences that learners are expected to acquire at various levels during the course of study.

Duration: This is the suggested time allocation for a given module within a specific academic year of study.

Module Overview: This contains the general summary of the content in the module.

Learning Outcome: This is the general learning objective of the given content in the module. It clarifies generally what the learner shall be able to do as a result of passing through the teaching and learning process.

Preparatory Assignment: This is the realistic guide for you, mainly on the way you should present the module content to stimulate the learner's curiosity to studying the module. It directs you on how you can directly inspire learners to like a particular course module. It should have an approach that arouses the learner's interest to research and explore in-depth the module at hand. This makes learners to relate what they are going to study with the reality in the world of work.

Result: This is the outcome of the tasks from the preparatory assignment. Each preparatory assignment must have results indicating the learner's participation, as this becomes the basis of continuous assessment.

Sub-module: This presents a topic with its content outline.

Competences: These are specific skills which the learner is expected to acquire and exhibit, during and after going through every specific module and sub-module content.

Content: This is an outline of the subject matter to be learnt in a particular module and within a prescribed timeframe.

Teaching/ Learning Strategies: These are methods that the teacher uses to facilitate learning that suit particular content and learners. The teaching/ learning strategies require the active participation of both you and the learners during the teaching/learning process.

Assessment Strategies: These are samples of class exercises, tests, laboratory tests as well as field and workshop practical activities given to the learners to perform in order to score the level of achievements of the completed content for both you and the learners.

Teaching/ Learning Resources: These are the identified teaching aids used by both you and the learners during teaching/learning to clarify the concept or ideal situation being learnt.

Aims of the NCAM Teacher's Guide

This Teacher's Guide is aimed at:

i) introducing and guiding you through the new concept of Competence Based Education and Training.

ii) supporting you with practical methodologies to equip learners with the skills required to solving the day to day societal needs by creating jobs to reduce unemployment.

iii) empowering you with creative and innovative teaching/learning methodologies to enhance learners' research and development.

iv) strengthening your ability to equip learners with knowledge and skills of marketing their enterprises and lobbing for any form of support.

v) guiding you to empower learners with knowledge and skills that will enable them upgrade to higher levels of education.

vi) pedagogically aiding you to equip learners with knowledge and skills for effective communication.

vii) providing methodologies that will guide you in equipping learners with basic Kiswahili to widen their communication and employment opportunities in the East African Community.

viii) directing you to foster an attitude change and understanding in learners and the public on the fact that "technical education is not for academic failures rather for more creative and gifted persons".

ix) guiding you on the use of local teaching/learning resources that aid the imparting of knowledge and skills to learners.

x) guiding you on approaches of administering continuous assessment so as to consolidate the achievement of competences and update the learners performance record.

How to Use this Teacher's Guide

You should ensure that the practical related knowledge, values and attitudes are integrated during the teaching/learning process. For effective implementation of this Teacher's Guide, you are expected to:

i) guide learners through the proposed preparatory assignment, or create own approach of introducing the module.
ii) actively participate, and stand as a role model for the learners to appreciate their choice of joining Technical Education.
iii) refer to the content of the outlined sub-module and extract the specific area to be learnt.
iv) extract competences, the teaching/ learning strategies and resources relative to the content.
v) Redistribute the total time allocated to each sub-module to suite the content.
vi) involve learners in active participation during the teaching and learning process.
vii) assess learners using the suggested assessment criterion or other effective assessment strategies relative to the competences .
viii) guide learners to effectively use the suggested teaching and learning resources to acquire the set competences.
ix) You are free to innovatively create resources for teaching/ learning other than the ones outlined.
x) during the teaching /learning process, you should ensure health, safety, security and environment.

Methodologies

The teaching/learning methodologies in this Teacher's Guide are just samples. It is at your discretion to apply any other methodologies deemed suitable to the classroom setting. The type of methodology selected should be guided by the competences to be acquired by the learner. You are encouraged to use a variety of

methodologies in a lesson to make it more interesting and practical. Examples of some of the teaching/learning methodologies include:

1. Discussion

(a) Group Discussions

Learners discuss issues in groups. This methodology enables knowledge/information to come from the learners rather than from the teacher. It promotes teamwork and allows all learners to have an opportunity to give their opinions and ideas; and also stimulates their interest as they learn from each other.

Guidelines for using group discussion methodology:

(i) Group learners
(ii) Give clear instructions to learners as to what each group should do
(iii) Assign task(s) to each group
(iv) Learners discuss issues raised in the task with your guidance.
(v) Learners agree on the issues to be presented.
(vi) Group presentations and general discussions.
(vii) Summary of agreed class points.

(b) Guided discussions

Guidelines for using guided discussion methodology:

(i) Lead the discussion and act as the chairperson/secretary.
(ii) Give clear instructions to learners as to what they should do.
(iii) Learners discuss issues raised in the task with your guidance.
(iv) Learners agree on the issues.
(v) Summarise the session by drawing on the main points.

2. Case Study

This methodology is where learners are given information about a situation and they have to come up with decisions or solutions to a problem. The purpose of case study is to:

(i) help learners to identify and solve problems in a typical situation.
(ii) provide learners with confidence in decision making.
(iii) help learners develop analytical skills.

3. Brainstorming

This is a way of obtaining as many views as possible from the learners in a short time. Guide the learners to give as many ideas as they can, on a particular issue. It is recommended that all ideas are accepted without questioning. The ideas should be ranked according to the relevance to the issue being brainstormed.

Basic Rules for Brainstorming

(i) Encourage as many ideas as possible.
(ii) Criticisms of ideas should not be allowed.

4. Buzz Methodology

This is a method of training that requires learners seated near each other to discuss an issue that could have a lot of points or controversy to be agreed upon. The noise is the murmur that the class makes like that of buzz. Therefore some manageable noise or murmur should not be mistaken for no learning. This method is good in situations where one cannot conduct effective training like when it is raining.

You should ask questions on what learners have discussed to find out if they have understood.

5. Guided Discovery

This method is based on the notion that the learners know more than they think they know. The assumption is that they only need to be prompted to discover this knowledge for themselves. Your role

is to organise the learning environment and present the content in such a way that the learners can discover more knowledge and ideas.

6. Demonstration

This is the act of exhibiting, describing and explaining the operation or process by use of a device, machine, process, product to learners. A demonstration can be carried out by the teacher or learners.

7. Illustration

This is a depiction or representation of a subject matter, such as a drawing, sketch, painting, photograph, or other kind of image of things seen, remembered or imagined, using a graphical representation. This method is best used where words are not sufficient to clearly bring out a concept. It gives a visual impression to what is being taught.

8. Guest Speaker

Guest speakers could be local entrepreneurs, government officials, professional practitioners, or community leaders invited to make a presentation to learners. Guest speakers can provide a variety to the entrepreneurship education learning, share experience, add value by engaging learners in an educational or informative manner.

The methodology provides learners with an opportunity to physically interact with a practitioner and motivates them to develop an entrepreneurial attitude.

9. Role Play

This methodology is where learners are presented with a situation they are expected to explore by acting out the roles of those represented in this situation. The role-play learners should be carefully selected and properly prepared for their roles. Prepare the remaining learners for the role play by briefing them on how they

are to act during the presentation. The players should try to behave naturally during the presentation.

You:

(i) observe when the presentation is taking place.

(ii) guide learners in the course of presentation to ensure that they focus on theme of the play.

(iii) engage learners in a discussion or ask them questions about what they have learnt from the role play with a view of finding out if the role play has provided sufficient information.

10. Study Tour

This is when learners are taken out to perform particular tasks with the aim of carrying out an observation, practise or witness the flow of events. It enables the learners to link the school situation with the reality in the communities or world of work.

11. Field Attachment

This is when learners are attached to some entrepreneur(s) to practice during their study time. It does not only enable them to relate what they have learnt in class but also allows them to acquire more knowledge and skills beyond what was covered. It further motivates learners to become practitioners or entrepreneurs.

Description of Year 1Term 1

Code	Module Title	Total Hours	Hours Per Week
TCTM 101	Applied Technician Mathematics I	40	4
TCCS 101	Life Skills	20	2
TCCA 101	Computer Application	40	4
TCAM101 I	Automotive Technology and Maintenance	50	5
TCAM 102 Practice I	Automotive Electric and Electronics	30	3
TCAM 103	Technician Science I	40	4
TCAM 104	Technical Drawing I	40	4
TCAM 105	Real Life Project I	40	4
TOTAL		**300**	**30**

TCTM 101: Applied Technician Mathematics I

Duration: 40 Hours

Module Overview

This module is designed to enable the learners attain some mathematical skills that will enable them carry out measurements and estimation. It introduces learners to calculation of cost of materials, solving problems related to fractions, decimals, percentages, ratios and proportions, areas and volumes of different figures and application of the laws of indices and logarithms.

Learning Outcome

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

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

Preparatory Assignment

Prior to teaching this module, task learners to take measurements of a selected area within the (e.g. workshop or playground) and sketch its surface plan on paper, write a report and make group presentation in class.

Result

Learners take compound measurements, sketch the surface plan of a compound, write a report and make group presentations in class.

Sub-module 1: Basic SI Units and Basic Arithmetic

Duration: 08Hours

Competences	Content	Teaching/ Learning Strategies
The learner : • converts millimetres to metres, kilograms to Newtons and tones. • calculates numbers involving HCM and LCM. • applies percentages in calculating material costs.	• Metric conversion of S.I units, area, volume ,total surface area • H.C.F, L.C.M, fractions and decimals • Percentages, ratios, and proportions	• Together with learners' involvement illustrate the conversion of millimetres to centimetres, kilogram's to Newton's and tones. • using illustrations, guide the learners through the methods of calculating areas and volumes of waste oil drained from an engine • Guide learners through practice to manipulate and determine LCM and HCF • Illustrate the calculation of percentages in relation to material costing and task learners to practise.

Assessment Strategies

Assign the learner to:

- convert metric units, from small to large units and vice versa.
- calculate numbers having LCM and HCF.

Teaching/Learning Resources

- Measuring rule
- Weighing scale
- Scientific calculator
- Computer
- Projector
- Surface area

Sub-module 2: Mensuration

Duration: 12 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • determines areas of irregular objects using Simpson, mid ordinate and trapezoidal rules. • interprets the drawings by taking scale rule measurements. • costs timber and using the areas and volume calculation methods.	• Calculation of area, Perimeter, Volume and total surface area for regular and irregular figures • Interpretation of given drawing/diagrams • Cost calculations in relation to areas and volumes • Areas of irregular figures [Simpson rule, mid ordinate rule, trapezoidal rule	• Demonstrate the taking of measurements for one room and guide learners through the method and formula for finding its floor area. • Guide learners through the method of calculating the cost of materials required for a given job. • Lead learners to practise calculating of the number of sections required to fabricate a vehicle base frame and the cost of purchasing sections. • Illustrate the manipulation of numbers using Simpson, mid ordinate and trapezoidal rules and task learners to practise.

Assessment Strategy

Assign the learner to calculate the number of timber required to make **four** trusses for a simple house.

Teaching/Learning Resource

Scientific calculator

Sub-module 3: Indices and Logarithms

Duration**:** 20Hours

Competences	**Content**	**Teaching/ Learning Strategies**
The learner**:** • applies the laws of indices in solving indicial equations. • rationalises and manipulates indicial equations. • evaluates the logarithms.	• Laws of indices and standard form, fractional and 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 logarithmic graph) • Natural logarithms	• Illustrate the various applications of the laws of indices to fractional and negative indices and task learners to practise. • Guide learners to apply the laws of indices when multiplying and subtracting numbers. • Lead learners to manipulate the various applications of the laws of indices in rationalising indicial equations. • Through demonstrations, guide learners to manipulate logarithms.

Assessment Strategy

Assign the learner to apply laws of indices to manipulate fractional and negative indices.

Teaching/Learning Resources

- Log tables
- Scientific calculator
- Bird J. O. And May, A.J.C.(1982). *Technician Mathematics*. Longman Higher Education Publisher
- Stroud, K. A. (1995). *Engineering Mathematics*. 4th Edition,Macmillan Press
- Elhance, D.N.,and Aggarwal, B. M. (2000). *Fundamental of Statistics*. New Delhi, Kitab Mahal.
- Backhouse, (1985). *Pure Mathematics*. 4th Edition, Longman.

TCCS 101: Life Skills

Duration: 20 Hours

Module Overview

The module equips learners with the skills applied in day-to-day interactions, application letter, CV and minutes writing, technical communications, note taking skills and 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.

Preparatory Assignment

Let the learners respond to a job advert in a given newspaper.

Result

Learners submit written applications to a job advert.

Sub-module 1: Introduction to Communication Skills

Duration: 6 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • listens, takes and makes notes. • speaks, interacts and	**Fundamental skills:** • Reading, listening and speaking	• Give the learner to loudly read a newspaper while others listen with focus on the pronunciation of words, punctuations and the tone variations

Competences	Content	Teaching/ Learning Strategies
conducts meetings. • makes an agenda and conducts meetings. • adopts the agenda. • agrees on the duration of the meeting. • talks and relates well with others at the work place.	• Note taking and note making • Conducting meetings • Conducting interviews **Interpersonal skills:** • Work place communication	applied. • Ask the listening learners to comment on what they heard. • Guide learners on the listening and note taking skill taking place at the same time. • Guide learners on the procedural rules followed when conducting meetings. • Moderate the learners meeting and keep guiding learners where necessary. • Lead a guided discussion on work place communications, public relations personnel and the standing orders of the firm.

Assessment Strategies

Assign the learner to convene a class meeting to discuss training needs, elect chairperson and minute secretary with agenda and minutes taken.

Teaching/Learning Resources

- Old news papers
- Sample minutes
- Standing orders of any legal firm
- Internet

Sub-module 2: Writing Skills

Duration: 10 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • formats work shop paper ready to be presented. • writes personal CVs, field report, memos, delegation letters, claim letters, stake holders circulars, demand notices.	• **Academic writing:** - Technical and scientific report writing, - Curriculum vitae and resume' writing - Authority and delegation letters - Circular letter writing • Office and business writing: - Intra and inter-office communication, - Business correspondence and memo writing. - Adverts and announcements writing	• Lead a guided discussion on the importance of CVs, field reports, paper presentation and friendly letters. • Illustrate the format of writing CVs, field reports and papers for presentation, memos, claim letters, and demand notices, delegation letters and circulars to stake holders and guide learners to practise.

Assessment Strategy

Assign the learner to write a personal CV and field report.

Teaching/Learning Resources

- Old news papers
- Samples Curriculum vitae (CVs)
- Internet

Sub module 3: Introduction to HIV and AIDS

Duration: 4 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • gives an account of the origin and history, prevalence rates and current trends of HIV in Uganda. • outlines some HIV and AIDS myths and misconceptions. • educates the public about the basic facts about HIV and AIDS.	• Back ground of HIV and AIDS : meaning, definition, history, current trends and prevalence • Myths and misconception on HIV and AIDS • Basic facts on HIV and AIDS	• Lead a guided discussion on the history, prevalence rates and current trends of HIV and AIDS in Uganda. • Guide learners in out lining the HIV and AIDS myths and misconceptions. • Guide learners to brain storm the important issues on HIV and AIDS that they need to educate public.

Assessment Strategy

Assign the learner to write a report on the myths and misconceptions about HIV and AIDS in Uganda.

Teaching/Learning Resources

- HIV and AIDS handbooks
- MoH charts on HIV
- Documentary
- Internet
- Computer
- TVs sets
- McKay, M. and Davis, M. (2009).*The Communication Skills Book*. 3rd Edition; New Harbinger Publications.

- Bough, B. (2005).*101 Ways to improve Your Communication Skills* Instantly.4th Edition; Goal Minds, Inc.
- Garner, E. (1995). *The Art of Communicating Skills Instantly*. 1st Edition;
- Bolton, R. (1986).*People: How to Assert Yourself, Listen to others, and Resolve Conflicts*. Touchston.

TCCA 101: Computer Applications

Duration: 40 Hours

Module Overview

*T*his module is designed to enable learners attain computer skills of typesetting reports and other documents, use of the Internet for searching required data, carry out simple connections and installations of a computer and its accessories.

Learning Outcome

By the end of the module, the learner should be able to use and manipulate a computer to prepare documents and search web based information from the Internet.

Preparatory Assignment

Learners are assigned to outline the practical differences between mobile phones and laptop computers.

Result

Learners make their analysis in groups, write a report and present in class.

Sub-module 1: Introduction to Computer

Duration: 10 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • identifies different types of computers and describes the application of computer	• Origin of computer • Types of computers and Computer hardware (CPU, hard disk	• Lead a guided discussion on the origin, types and uses of computers and their uses. • Display computer software and hardware components and ask

Competences	Content	Teaching/ Learning Strategies
hardware, CPU, hard disc drives, modems, mouse, external speakers. • removes and replaces computer rams. • identifies and uses keyboard burtons as per their functions. • differentiates between letter and numerical buttons on keyboard. • typesets data into the computer using keyboard. • opens, closes, restarts and changes user accounts. • ensures safety and security of a computer.	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 • Computer Software; classification, types, usage and Computer components; (Video card, network cards, cables, ROM, RAM, monitors, printers, cameras, processors) • Safety and Security of a computer	learners to identify and group the items to their correct order. • Lead a guided discussion on computer soft ware, classification, usage, Computer components; video card, network cards, cables. • Demonstrate the use of computer cameras. • Demonstrate the removal and replacement of computer rams and task learners to practice. • Guide learners to use the key board, its burtons and other functions. • Lead learners to manipulate the typing techniques applied when using computer key board. • Demonstrate the procedure followed to open, change and close accounts. • Guide learners to implement the safety practices of a computer - Lead a guided discussion on the safety and security measures of a computer i.e. storage, transportation.

Assessment Strategies

Assign the learner to:

- identify and sorts out computer hardware, components according to their application.
- remove and replace computer rams.
- practise key board, its use and application skills and techniques.
- practise starting, changing accounts and closing a computer.

Teaching/Learning Resources

- Computer
- Mice, modems and flash discs
- External drives
- Key boards
- Memory cards
- Ram sets
- Cameras
- Key boards
- CPU
- Monitor/screen
- Power generator
- cables

Sub-module 2: Operating System

Duration: 6 Hours

Competences	**Content**	**Teaching/ Learning Strategies**
The learner: • describes computer operation system, types and functions.	• Functions of an operating system • Types and classification of operating	• Lead a guided discussion on computer operating system and its functions. • Guided learners

Competences	Content	Teaching/ Learning Strategies
• installs and uninstalls windows operating system, application software and other support programmes .	system and benefits of operating Systems • Installation of windows operating system and application software	through a discussion on types, classification and benefits of computer operating system. • Demonstrate the procedure of installing and uninstalling operation system and other support computer programmes.

Assessment strategy

Assign the learner to install and uninstall the computer operating system.

Teaching/Learning Resources

- Computers with installed operating system
- Soft copies of operating system
- Computers

Sub-module 3: Desktop Main Menu

Duration: 4 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • locates the desktop start menu, creates desktop background and screen saver. • changes desktop	• Start Menu, applications menu, working with the desktop; background, screen saver	• Task learners to locate desktop start menu. • Guide learners to create desktop background and screen saver from

Competences	Content	Teaching/ Learning Strategies
background and screen saver. • resizes, opens windows by maximising and minimising to task pane. • closes and opens windows from task pane. • copies files from external drive, CD, DVD, flash disc to desktop. • identifies icons on desktop and their application.	• Manipulating Open Windows; Resizing, maximising, minimising, Task pane, and Tiling windows etc • Copying files from different locations • Icons, Files and Folders	default settings and from pictures or photographs saved in the computer. • Demonstrate the techniques of resizing windows, minimising and maximising open windows. • Guide learners through the techniques of copying files external drives, CDs, DVDs, flash discs to desktop and vice versa. • Illustrate the application of various icons on desktop and task them to practice.

Assessment Strategies

Assign the learner to:

- create desktop background and screen saver from default settings and pictures or photographs saved in the computer.
- resize windows, minimising and maximising open windows.

Teaching/Learning Resources

- Functioning computers
- External drives CDs, DVDs, flash discs
- Monitors/screens

Sub-module 4: Word Processing

Duration: 20 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • starts, creates or opens a Word window, works with text and manages files. • uses Word menus for document editing; e.g. copy, paste, cut. • saves a document in different formats and to storage media e.g. flash disc. • formats a page and documents.	• 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 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	• Guide learners to open new documents, work with text and manage files. • Lead learners through practice to use Word menus for document editing; e.g. copy, paste, cut. • Guide learners through demonstrations and practise to save a document in different formats and to a storage media, e.g. flash disc. • Guide learners to format a page and documents. • Use demonstrations to guide learners in creating mails and mail merging.

Assessment Strategy

Assign the learner to:
start, create or open a word window and work with text and manage files.

Teaching/Learning Resources

- Computers/laptops
- Flash discs
- CDs rewritable
- Office Software (2003 and 2007 or later)
- Projector
- Murray, H. (2003).*Teach Yourself Basic Computer Skills*. New Edition; Teach Yourself Books.
- Raisi, F. A. (2011).*Basic Computer Skills*. 1st Edition; Sultan Qaboos, University College of Science.

TCAM 101: Automotive Technology and Maintenance I

Duration: 50 Hours

Module Overview

The module equips learners with the skill of troubleshooting faults, repairing and maintaining a vehicle to good working condition.

Learning Outcome

By the end of this module, the learner should be able to practise workshop safety and regulations, identify fitting and holding tools, apply various methods of joining materials, locate parts of vehicle layout, identify parts of engine systems, and describe the construction, troubleshoot faults, repair and maintain the transmission system of a vehicle.

Preparatory Assignment

Learners are given a vehicle in the workshop and tasked to open the bonnet.

Result

Learners open the bonnet.

Sub -module 1: Workshop Safety and Regulation

Duration: 4 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • practises and observes workshop safety regulations, hazards and incidents like fire, electric shock and fumes. • uses overhead cranes, chain block when lifting heavy loads. • administers first aid to accident victims. • cleans and organises the workshop.	• Workshop regulations, precautions and hazards; Behaviour while in the workshop, • Lifting of heavy loads in the workshop • How to deal with hazards and incidents like fire, electric shocks, fumes and gases • First aid in the workshop, factories and sites • Organisation of the workshop.	• Lead a guided discussion on identifying, observing and practising the various workshop regulations, hazards and incidents. • Demonstrate how to lift heavy loads by hands and using the overhead crane and chain block; task learners to lift an old engine block up to the height of 10 meters above the workshop floor. • Guide learners through the procedure of administering first aid to accident victims. • Guide learners through practice to clean and organise the institute workshop.

Assessment Strategy

Assign the learner to practise workshop safety and regulations.

Teaching / Learning Resources

- Safety standards
- Display charts
- Machines
- Fire fighting equipment
- Safety gears
- Internet

Sub -module 2: Fitting and Holding Tools

Duration: 4 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • identifies and correctly uses different hand tools and devices. • ensures the health, safety and security when using fitting and holding tools.	• Files • Scrapers • Hacksaws • Chisels • Hammers • Punches • Vices • Health, safety and security of fitting and holding tools.	• Display the tools and task learners to identify fitting and holding tools and select them according to their use during repair and fabrication. • Guide learners through practice how the different hand tools are used. • Guide learners through practice on how to sharpen different types of hand tools. • Demonstrate on how to keep and care for

Competences	Content	Teaching/Learning Strategies
		hand tools/ instruments. • Demonstrate how to ensure the health, safety and security when using fitting and holding tools.

Assessment Strategies

Assign the learner to identify fitting and holding tools and select them according to their use during repair and fabrication.

Teaching/Learning Resources

- Safety standards
- Various fitting and holding tools
- Display charts
- Internet

Sub -module 3: Methods of Joining Materials

Duration: 6 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • applies various methods of joining materials. • explains the various	• Rivets and riveting • Rebates and rebating • Bolts and nuts • Adhesive bonding • Locking devices • Health , safety and	• Guide learners through practice on the application of various methods of joining materials.

Competences	Content	Teaching/Learning Strategies
procedures of joining materials. • ensures health, safety and security when joining materials.	security when joining materials	• Demonstrate the health, safety and security of environment when joining materials.

Assessment Strategy

Assign the learner to apply various methods of joining materials.

Teaching / Learning Resources

- Safety standards
- Rivets
- Locking device
- Adhesives
- Bolts and nuts
- Riveting gun
- Display charts
- Internet

Sub-module 4: Conventional Vehicle Layout

Duration:6 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • locates and illustrates the main parts of conventional vehicle layout.	• Arrangement of vehicle components • Body and chassis design for motor	• Illustrate the location of the main parts of conventional vehicle layout. • Illustrate different

Competences	Content	Teaching/Learning Strategies
• illustrates different body chassis for motor vehicles and cycles. • maintains the suspension system. • observes the health , safety and security in design of vehicle layout.	vehicles • Body and chassis design for motor cycles • Maintenance of the suspension system • Health , safety and security observed in design of vehicle layout	body chassis for motor vehicles and cycles • Guide learners through practice on the maintenance of suspension system. • Guide learners through practice on the Health , safety and security of environment in design of vehicle layout

Assessment Strategy

Assign the learner to maintain the suspension system of a vehicle and motorcycle.

Teaching / Learning Resources

- Safety standards
- Required spanners
- Vehicle
- Display charts
- Motorcycle
- Internet

Sub-module 5: Engine

Duration: 6 Hours

Competences	Content	Teaching/Learning Strategies
The learner • describes the construction of different engines • describes the operation of different engines • ensures the health, safety and security of vehicle and engine.	• Types of engines • Engine construction • Engine cycles of operation • Health, safety and security of vehicle and engine.	• Lead a guided discussion on the description of engine construction. • Guide learners through practice on the operation of an engine. • Demonstrate how to ensure the health, safety and security of vehicle and engine.

Assessment Strategy

Assign the learner to describe the engine construction and their operations.

Teaching / Learning Resources

- Internet
- Guided tours to sites
- Workshops gears
- Petrol engine
- Diesel engine
- Motor cycle engine
- Tool box
- Computer
- DVD Player

Sub-module 6: Engine Systems

Duration: 16 Hours

Competences	Content	Teaching /Learning Strategies
The learner : • illustrates the layout of the components in the fuel, cooling and lubrication systems. • describes the construction and operation of the fuel, cooling and lubrication systems. • repairs and maintains the fuel, cooling and lubrication systems. • ensures the health , safety and security of vehicle during repair of engine systems.	• Fuel supply system • Cooling system • Lubrication system • Repair and maintenance of the engine systems • Health, safety and security of vehicle and engine systems.	• Illustrate the layout of the components in the fuel, cooling and lubrication systems. • Guide learners through practice on the operation of the fuel, cooling and lubrication systems. • Guide learners through practice on the procedure of maintaining the fuel, cooling and lubrication, systems. • Demonstrate how to ensure the health, safety and security of vehicle during repair of engine systems.

Assessment Strategy

Assign the learner to demonstrate the procedure of maintaining the fuel, cooling, lubrication, ignition, starting and charging systems.

Teaching / Learning Resources

- Charts
- Models
- vehicle
- Site/Industry
- Internet

Sub-module 7: Transmission System

Duration: 8 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • describes the construction and operation of the transmission system. • troubleshoots, repairs and maintains the clutch and gearbox. • ensures the health , safety and security of vehicle during repair of Transmission System	• Clutch system • Gearbox system • Repair and maintenance • Health , safety and security of vehicle and Transmission System	• Lead a guided discussion on construction and operation of the transmission system. • Guide learners through practice to troubleshoot, repair and maintain the transmission system. • Demonstrates how to ensure the health , safety and security of vehicle during repair of Transmission System

Assessment Strategy

Assign the learner to troubleshoot, repair and maintain the clutch and gearbox.

Teaching / Learning Resources

- Gear box
- Clutch system
- Tool box
- Slides and display charts
- Workshops gears
- Models
- Internet
- Gupta, G. K. (1985).*Workshop Technology*. 3rd Edition; Macmillan Press Ltd.
- Hillier, V.A.W. (1986).*Fundamentals of Motor Vehicle Technology*. 5th Edition; Macmillan press Ltd.
- Mudd, S.C., (1986).*Technology for Motor Mechanics*. 2nd Edition; Edward Arnold (publishers) Ltd.
- Stockel, M.W. and Stockel, M. T., (1984). Auto Service and Repair. 4th Edition; Good Heart, Willicox Company,Inc.

TCAM 102: Automotive Electric and Electronics Practice I

Duration: 30 Hours

Module Overview

The module enables learners to troubleshoot electrical faults, repair and maintain the electrical components of the vehicle. It also introduces to the learners the concept of automotive electrical technology and practice.

Learning Outcome

By the end of this module, the learner should be able to describe the principles of electricity, calibrate electrical instruments and ensure their safety, prepare electrolyte for battery, describe the construction and operation of the Conventional Ignition System, its timing and maintenance.

Preparatory Assignment

Learners are given battery and tasked to determine the specific gravity of the electrolyte.

Result

Learners determine the specific gravity of the electrolyte.

Sub-module 1: Fundamentals of Electricity

Duration: 4 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • describes the principles of electricity and terms used.	• Principles of electricity • Protection	• Lead a guided discussion on the principles

Competences	Content	Teaching/Learning Strategies
• calibrates electrical instruments and observes safety against hazards of electricity.	against hazards of electricity • Measurements and Measuring instrum	of electricity. • Demonstrate the calibration of electrical instruments and procedure of observing safety against hazards of electricity. • Display and guide learners through practice on the operation of measuring instruments.

Assessment Strategy

Assign the learner to display and demonstrate the operation of measuring instruments.

Teaching / Learning Resources

- Measuring tools
- Wall chart
- Internet
- Battery
- Working table
- Wiring board
- Wires
- Bulbs
- Switches
- Relay
- Connectors
- Circuit breaker

Sub-module 2: Battery

Duration-14 Hours

Competences	**Content**	**Teaching/Learning Strategies**
The learner: • prepares electrolyte for battery and maintains the battery for proper service. • explains the procedure of maintaining the battery for proper service. • ensures the health, safety and security of vehicle and its environment during maintenance of batteries.	• Battery structure and electrolyte • preparation of electrolytes • Electro chemical process in battery • Construction design of battery • Maintenance of batteries • Health, safety and security of vehicle and its environment during maintenance of batteries.	• Guide learners through practice on the procedure of preparing battery electrolyte. • Guide learners through practice on procedures of maintaining the battery for proper service. • Demonstrates how to ensure the health, safety and security of vehicle and its environment during maintenance of batteries.

Assessment Strategies

Assign the learner to prepare electrolyte for battery and maintain the battery for proper service

Teaching / Learning Resources

- Battery
- Battery charger
- Electrolyte
- Battery tester

- Measuring instrument
- Internet
- Transparencies
- Protective goggles
- Protective cloth
- Water
- Power source
- Work table

Sub-module 3: Conventional Ignition System

Duration: 12 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • describes the construction and operation of the Conventional Ignition System. • carries out ignition timing and maintains the ignition system. • demonstrates adjustment of spark plug gaps • ensures the health , safety and security of vehicle during repair of Ignition system	• Centrifugal advance and vacuum control • Multi stage ignition • Ignition distributor • Spark plugs • Ignition timing and repair • Health, safety and security of vehicle and Ignition system	• Lead a guided discussion on construction and operation of the Conventional Ignition System. • Guide learners through practice on ignition timing and maintenance of the ignition system. • Guide learners through practice on adjustment of spark plug gaps • Demonstrate how to ensure the health, safety and security of vehicle during repair of Ignition system.

Assessment Strategy

Assign the learner to carry out ignition timing and spark plug adjustment.

Teaching / Learning Resources

- Vehicle
- Measurement tools
- Spanners
- Spark plugs
- Drawing charts
- Working tables
- Internet
- Gupta, G. K., (1985). *Workshop Technology*. 3rd Edition; Macmillan Press Ltd.
- Hillier, V.A.W., (1986). *Fundamentals of Motor Vehicle Technology*. 5th Edition; Macmillan press Ltd.
- Mudd, S.C., (1986). *Technology for Motor Mechanics*. 2nd Edition; Edward Arnold (publishers) Ltd.Stockel, M. W. and Stockel, M. T.(1984). *Auto service and Repair*. 4th Edition; Good Heart Willicox Company, Inc.

TCAM 103: Technician Science I

Duration: 40 Hours

Module Overview

The module equips learners with the skill of analysing the effect of forces on engineering materials used in the sizing of materials for production.

Learning Outcome

By the end of this module, the learner should be able to analyse the effect of forces on engineering materials used in the sizing of materials for production.

Preparatory Assignment

Task learners to determine the resultant of three concurrent coplanar forces

Result

Learners determine the resultant of three concurrent coplanar forces.

Sub-module 1: Force and Moments

Duration: 20 Hours

Competences	Content	Teaching and Learning Strategies
The learner: • illustrates the resolution of forces using different methods. • applies	• Types of forces • Triangle of forces • Bow's notation • Resolution of forces	• Illustrate and demonstrate resolution of forces and determine their resultant using different methods. • Guide learners

Competences	Content	Teaching and Learning Strategies
principle of moments in solving problems of reactions of support, levers, torque and centre of gravity.	• Principle of moments • Levers • Toque • Reaction of support • Centre of gravity	through the application of principle of moments to solve problems of levers, torque, reaction of supports and centre of gravity.

Assessment Strategy

Assign the learner to resolve forces and determine their resultant.

Teaching / Learning Resources

- Graph paper
- Lever
- Calculator
- Drawing instruments
- Internet

Sub-module 2: Work, Power and Energy

Duration: 10 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • differentiates between, work power and energy • solves problems on work, power and energy possessed by a moving vehicle.	• Force and distance • Work input • Work output • Work done in rotation • Power • potential and kinetic energy	• Lead a guided discussion on work, power and energy possessed by moving vehicle. • Guide learners through practice on the methods of calculating work, power and energy.

Assessment Strategy

Assign the learner to determine work, power and energy possessed by a moving vehicle.

Teaching / Learning Resources

- Slides and display charts
- calculator
- Slides and overhead projector
- internet

Sub-module 3: Stress and Strain

Duration: 10 Hours

Competences	Content	Teaching/Learning Strategies
The learner calculates the stress and strain of a loaded material and determines the modulus of elasticity.	• Types of stress and strain • Young's modules of elasticity and Hooke's law • Modulus of rigidity	• Lead a guided discussion on stress and strain. • Guide learners through practice on the method of calculating the stress and strain of a loaded material and determine the modulus of elasticity.

Assessment Strategy

Assign the learner to calculate the stress and strain of a loaded material and determine the modulus of elasticity.

Teaching / Learning Resources

- Slides and display charts
- calculator
- Slides and overhead projector
- Internet
- Gupta, G. K. (1985).*Workshop Technology*. 3rd Edition; Macmillan Press Ltd.
- Hillier, V.A.W.(1986). *Fundamentals of Motor Vehicle Technology*. 5th Edition; Macmillan press Ltd.
- Mudd, S.C., (1986).*Technology for Motor Mechanics*. 2nd Edition; Edward Arnold (publishers) Ltd.Stockel, M. W. and Stockel, M. T. (1984). *Auto service and Repair*. 4th Edition; Good Heart Willicox Company, Inc

TCAM 104: Technical Drawing 1

Duration: 40 Hours

Module Overview

This module equips the learner with the skill of reading, interpreting, and producing working drawings.

Learning Outcome

By the end of this module, the learner should be able to read, interpret, and produce working drawings.

Preparatory Assignment

Task learners to design a component (e.g. spanner) to a specified shape and size

Result

Learners design a component (e.g. spanner) to a specified shape and size.

Sub-module I: Introduction to Technical Drawing

Duration: 8 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • uses engineering drawing as a means of representation and communication.	• Aims and purpose of engineering drawing; • Use and care of drawing equipment; drawing	• Lead a guided discussion on the aims and purpose of engineering drawing. • Demonstrate the lettering

Competences	Content	Teaching/Learning Strategies
• applies lettering techniques for labelling and dimensioning. • applies the different types of lines in construction	boards, drawing set, set squares, tee-square, scale rule, French curves and flexible rod, clips, compass, protractor among others; • Types and sizes of drawing boards, tee square and drawing papers (A0, A1, A2, A3, A4); • Drawing paper layout: types of title blocks and their application; Types of lines and their application • Lettering techniques printing styles	techniques – printing styles and guide learners to practice lettering • Guide learners through practice on the method of dividing the drawing paper in different sizes and apply the different types of lines in construction.

Assessment Strategy

Assign the learner to set the paper and apply different lettering techniques / printing styles.

Teaching / Learning Resources

- Drawing papers
- Drawing instruments
- Display chart
- Internet

Sub-module 2: Geometrical Constructions

Duration: 10 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • constructs perpendicular and parallel lines. • constructs a triangle and inscribe, describe and circumscribe circles to it.	• Construction of perpendicular and parallel lines • Construction of angles by bisection • Bisection of a line. Division of a line into equal parts and given ratios; Inscribe, describe and circumscribe circles on a drawn triangle; • Determination of the centre of a circular arc/circle • Determination of the circumference of a circle	• Guide learners through practice on the construction of: perpendicular and parallel lines, angles by bisection; bisecting a line, dividing a line into equal parts, and dividing a line into proportions, inscribed, described and circumscribing circles to a triangle. • Guide learners through practice on the procedure of determining the centre of a circular arc/circle. • Guide learners

Competences	Content	Teaching/Learning Strategies
	graphically	through practice on the procedure of determining the circumference of the circle graphically.

Assessment Strategy

Ask the learner to:

- bisect lines.
- divide a line into equal parts; divide a line in given proportion.
- construct a triangle and inscribe, describe and circumscribe circles to it.
- construct angles by bisection.
- determine the circumference of a circle graphically.
- construct described, inscribed and circumscribing circles.

Teaching / Learning Resources

- Drawing instruments,
- Display charts,
- Drawing papers
- Internet

Sub-module 3: Simple Geometrical Plane Figures

Duration- 12 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • constructs to scale: triangles, quadrilaterals, rectangles, squares,	• Construction of simple plane figures (triangles, rectangles, squares,	• Guide learners through practice on the construction of: quadrilaterals, regular and irregular polygons.

Competences	Content	Teaching/Learning Strategies
rhombus, trapezium, Regular and irregular polygons. • constructs to scale circles with different properties.	trapezium, rhombus and other regular and irregular polygons to scale • Circle and its properties	• Guide learners through practice on construction of circles with different properties. • Display charts of plane figures.

Assessment Strategy

Learner should be able to:

- draw polygons to scale.
- draw to scale plane figures.

Teaching / Learning Resources

- Drawing papers
- Drawing instruments
- Display chart
- Drawing papers
- Internet

Sub-module 4: Principles of Tangency

Duration: 10 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • draws an arc touching a straight line and an arc touching another arc internally and	• Arc to straight line • Arc to arc externally • Arc to arc internally • Construction	• Guide learners through practice on the drawing of: An arc touching a straight line; an arc touching another arc externally; an arc

Competences	Content	Teaching/Learning Strategies
externally. • constructs external and internal tangents to equal and unequal circles.	of external and internal tangents to equal and unequal circles	touching another arc internally. • Guide learners through practice on the procedure of constructing external and internal tangents to equal and unequal circles.

Assessment Strategy

Learner should be able to:

- draw a shape with arcs touching a line and circles externally and internally.
- construct external and internal tangents to equal and unequal circles.

Teaching / Learning Resources

- Drawing paper
- Drawing instruments
- Display chart
- Internet
- Pickup, F. and Parker, M. A. (1982). *Engineering Drawing*. 3rd Edition: Cop Clark Pitman Publisher
- Bankole, A., (1991). *Technical Drawing*. 1st Edition: Longman
- Staurt, B. (1982). *Graded Exercises in Technical Drawing*. 1st Edition: Longman.
- Bert. B. (2013). *Basic Technical Drawing*. Kindle Edition, BirkhauserVerlag AG.

TCAM 105: Real life Project I

Duration: 40 Hours

Module Overview

This module equips the learner with the practical skills in fabrication, drawings, forming/machining, joining, fitting, finishing and assembly of various engineering components. The project equips the learner with practical skills in analysing design requirements, selection of materials, assembling of functioning systems, selecting troubleshooting methods, dismantling and assembling machine parts to their proper functioning.

Learning Outcomes

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

- fabricate, draw, form/machine, join, fit, finish and assemble various engineering components.
- analyse designs, select materials, assemble functioning systems, select troubleshooting methods, dismantle and assemble machine parts to their proper functioning.
- observe health, safety and ensure security of the equipment during execution of project activities.

Preparatory Assignment

Task learners with expert assignment at every stage of real life project

Result

Learners do the expert assignment at every stage of real life project (Initiation, Planning, Execution, Control and Closure).

Duration: 40 Hours

Competences	**Content**	**Teaching/Learning Strategies**
The learner: • prepares and interprets engineering drawings.	**Projects** • fabricate casement hinge	• Illustrate the drawings for

Competences	Content	Teaching/Learning Strategies
• identifies materials/tools and machines. • innovates and modifies components. • carries out shaping operations: filing, sawing, casting, forming, machining, tapping and dyeing. • carries out heat treatment of machine parts. • selects the troubleshooting methods to identify the faults. • interprets the operation manuals. • identifies materials and consumables. • selects the tools and components. • dismantles and assembles machine parts. • tests and operates the transmission system. • costs and quantifies materials. • assembles components. • tests the machine. • demonstrates the health , safety and security of equipment during execution of project activities. • prepares project reports.	• fabricate round charcoal stove using rivets • fabricate waste disposal units • fabricate axle stand • fabricate vehicle seat stand • fabricate vehicle rack • Repair tyres • alignment wheel s • spray / re-spray vehicle body • Tool box • Dust pan • Spanner • G-clamp • Screw jack • Gear box final drive overhaul • Design and wire on aboard a conventional lighting circuit NOTE: *The project(s) should be completed by the end of first year.*	the unit to be fabricated. • Lead a guided discussion on the safety measures to be observed during fabrication. • Guide learners through practice on the fabrication processes at each stage. • Demonstrate the health, safety and security of equipment during execution of project activities. • Guide learners how to prepare project reports.

Assessment Strategy

Assign the learner to fabricate a simple component or maintain an engine to good working condition.

Teaching / Learning Resources

- Instruments and equipment
- Safety standards
- Project materials
- tools
- Charts
- Models
- Internet

- Chapman, J. K.,(1983). *Workshop Technology*. 4th Edition: Macmillan Press Ltd.
- Gupta, G. K., (1985). *Workshop Technology*. 3rd Edition: Macmillan Press Ltd.
- Hillier, V. A.W., (1986). *Fundamentals of Motor Vehicle Technology*. 5th Edition; Macmillan press Ltd.
- Mudd, S. C., (1986).*Technology for Motor Mechanics*. 2nd Edition: Edward Arnold (publishers) Ltd.
- Pritchard, R. T., (1979).*Technician Workshop Processes and Materials.* 3rd Edition: Hodder and Stoughton Ltd.
- Stockel, M.W. and Stockel, M. T., (1984). *Auto Service and Repair.* 4th Edition: Good Heart Willicox Company,Inc.

Description of Year 1 Term II

Code	Module Title	Total Hours	Hours Per Week
TCTM 101	Applied Technician Mathematics I	40	4
TCCS 101	Life Skills	20	2
TCCA 101	Computer Application	40	4
TCAM 101	Automotive Technology and Maintenance I	50	5
TCAM 102	Automotive Electric and Electronics Practice I	30	3
TCAM 103	Technician Science I	40	4
TCAM 104	Technical Drawing I	40	4
TCAM 105	Real life Project I	40	4
Total Term Load		**300**	**30**

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 equips a learner with mathematical skills and knowledge for marking out during fabrication of angular components.

Learning Outcome

By the end of this module, the learner should be able to determine the size and shaping of materials required and their related costs.

Preparatory Assignment

Before teaching this module, task the learners in groups to set out a pipe bend and fitting of 135^{o} on the sheets.

Result

Learners set out a pipe bend and fitting of 135^{o} on the sheets and present in class for discussion.

Sub-module 4: Trigonometry

Duration: 26 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • describes Pythagoras theorem and calculates for the sine, cosine and tangent of a	• The general angle, • Pythagoras theorem, • graphs of trigonometric al functions,	• Illustrate the approaches used to develop and prove Pythagoras theorem and guide learners to practice. • Using examples, demonstrate the

Competences	Content	Teaching/ Learning Strategies
right angled triangle. • calculates the ladder safe leaning angles and roof pitches. • manipulates trigonometrically ratios of 30^0, 45^0, 60^0 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.	• Trigonometrical ratios of 30°, 45°, 60°. • The sine formula, • Cosine formula • Tangent formula • Half angle formula • Heights and distances	application of right angled triangle by technicians in setting structures and templates • Guide learners through the manipulation of angles for the leaning ladders and roof pitch angles, the hypotenuse, opposite and adjacent sides of a triangle • Illustrate the manipulation of trigonometrical ratios and drawing of trigonometric graphs and guide the learners to practice. • Demonstrate the derivation of the sine, cosine and the tangent formulae • Guide learners to calculate triangle heights and sides using the half angle formulae • Illustrate techniques of determining areas using the sine, cosine and tangent formulae and task learners to practice.

Assessment Strategies

Assign the learner to:

- calculate the sine, cosine and tangent angles of a right angled triangle.
- determine the opposite, adjacent and the hypotenuse sides of a right angled triangle.

Teaching/Learning Resources

- Scientific calculator
- Graph paper
- Measuring rules
- Scale rule

Sub-module 5: Matrices

Duration: 14 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • adds and subtracts matrices. • transposes matrices. • calculates the determinants of matrices.	• 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	• Guide learners on methods applied in adding, subtracting and multiplying matrices and task them to practise. • Illustrate the methods of transposing a matrix, manipulation of determinants of a matrix and guide learners to practise.

Assessment Strategy

Assign the learner to add, subtract, multiply and transpose matrices.

Teaching/Learning Resources

- Scientific calculator
- Mathematical set
- Hard board
- Graph papers
- Log table
- Bird J. O. (1982). A.J.C. May. Technician Mathematics. Longman Higher Education Publisher, ISBN-13:978-0582412569.
- Stroud K. A. (1995). Engineering Mathematics. 4th Edition; Macmillan Press Ltd, ISBN 0-333-62022-4.

TCCS 101: Life Skills

Duration: 20 Hours

Module Overview

The module is intended to enable the learner improve their discourse skills, writing skills, prepare and make presentations and sensitise 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 one's behaviour and protect self and others against HIV and AIDS.

Preparatory Assignment

Learners stage a play {25 to 30} minutes on the theme "Spread and control of HIV and AIDS". Encourage learners to take part in the play by sharing the advantages of educating themselves, their colleagues and the public on HIV and AIDS.

Result

Learners organise themselves for the role play, act on the play and educate the colleagues and general public on behaviour change. Teacher analyses the play and emphasises on behaviour change.

Sub-module 4: Discourse Writing

Duration: 10 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • writes definitions of terms and descriptions of events correctly and 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.	• Definition and descriptive writing • Comparison and contrast • Narration and arguments	• Lead guided discussion on the application of definition and description as related to the programme of study. • Illustrate various approaches applied when defining and giving a description. • Guide learners using examples such as choosing one's career, the application of comparisons and contrast writing and its importance in decision making. • Task learners to narrate their ordeal on the first day at the institute, encouraging them to state what they had expected.

Assessment Strategy

Assign the learner to write the arguments on the economic importance of joining the skills training institution to offer a programme of study after ordinary level.

Teaching/Learning Resources

- Internet
- Newspapers
- UNBS data

Sub-module 5: Presentations

Duration: 06 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • prepares the seminar document and makes presentations. • prepares a classroom report and makes a presentation in the class. • prepares a public document and presents it.	• preparation and presentation of seminar documents • preparation, assessment and presentations of class room report • preparation and presentations of public document	• Lead a guided discussion on the importance of preparing documents to be presented to particular audience, emphasising on ethical values. • Using examples, illustrate the format of a seminar paper to be presented to a particular audience. • Divide learners into groups and task them to prepare and make a presentation on the challenges faced in their course of study, proposals should include the suggested way forward. • Display a documentary of some presentations and task the learners to critique the presentations.

Assessment Strategy

Assign the learner to prepare a presentation on the chosen topic.

Teaching/Learning Resources

- The internet
- Documentary
- Sample presentations
- News letters

Sub-module 6: Spread and Control Measures of HIV and AIDS

Duration: 4 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • identifies and describes the modes of transmission of HIV and 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.	Modes of transmission • Risk factors • Preventio n of HIV and AIDS • Behaviour change	• Lead a guided discussion on HIV and AIDS modes of transmission, risk factors fuelling the spread of HIV and AIDS and risk management possibilities. • Take learners to the nearby health facility or to meet with the HIV and AIDS positive leaving patients and task them to interact with the patients and come with testimonies. • Ask learners to share various testimonies got from HIV and AIDS patients and task them to recommend the way forward to the fight of the killer disease. • Demonstrate the best use of a condom using artificially made penis and vagina and a documentary.

Assessment Strategies

Assign the learner to:

- interact with HIV and AIDS positive living patients as they share their testimonies and write a report to be presented in class and in groups.
- demonstrate the best use of male and female condoms.

Teaching/Learning Resources

- Condoms
- Artificial made penis
- Bed towels
- Gloves
- Water and soap
- McKay, M. and Davis, M. (2009). *The Communication Skills Book.* 3rd Edition: New Harbinger Publications.
- Bough, B. (2005). *101 Ways to improve Your Communication Skills Instantly.* 4th Edition: Goal Minds, Inc.

TCCA101: 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 Outcome

The learner should be able to prepare documents on spread sheets and use the internet to search for the required information.

Preparatory Assignment

Group learners and task them to write and type set tabulated data and make one print out.

Result

Tabulated data and print out produced by learners.

Sub-module 5: Printing, Scanning and Copying Documents

Duration: 4 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • installs the printer to a computer. • describes the procedure followed when printing documents. • removes used	• Printing documents • Working with printer cartridges and toners • Scanning documents	• Lead a guided discussion on computer printers, scanner, cartridges and toners. • Guide learners through the procedure involved in installing the printer to a computer, and printing a document. • Demonstrate the

Competences	Content	Teaching/ Learning Strategies
up cartridges and toners and replace or refill them. • scans a document or pictures, saves and prints.	and pictures • Copying	techniques applied to remove used up cartridges and toners and their replacement or refilling. • Guide learners through the scanning and copying of documents and pictures. • Group learners and task them to discuss, and present the safety, security and health precautions on printing and scanning gadgets.

Assessment Strategies

Assign the learner to:

- install and uninstall computer printers.
- remove and replace the used up tonners.

Teaching/Learning Resources

- Working computers
- Power generator
- Working printer
- Working scanner
- Used up tonner and cartridges
- Useful tonner and cartridges
- Flash disc
- CDs

Sub-module 6: Internet and E-mail

Duration: 16 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • 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 and sends email messages. • reads received mails. • draws charts and graphs using internet. • observes the security, health and safety	• The Internet, web Browsers • Opening a websites; website address (url), • Internet searching and search engines • Saving information from the Internet, downloading files, music, pictures to the computer • Electronic mail - Creating email accounts - E-mail folders and attachments - Attaching documents to outgoing email - Downloading email attachment from incoming email - Formatting mail	• Lead a guided discussion on use of internet, web browser and emails. • Illustrate the LAN connection skills of two computers to share one printer and guide learners to practice. • Guide learners through the procedure of opening up internet web, opening of new email address and the creation of strong pass word for their email addresses. • Guide learners in copying and down loading of documents, music, movies and pictures and the saving into the computer or CD or flash disc.

Competences	Content	Teaching/ Learning Strategies
practices when using the Internet.	- Searching mail • Security, safety and health practices to be observed when using the internet and email	• Lead learners in opening and reading of mails, sending and deleting of the received and read mails. • Guided learners to discuss the security, safety and health practices to be observed when using the internet and email

Assessment Strategies

Assign the learner to:

- open new e-mail addresses, write, send and read mails.
- copy and download documents from the internet web browser and save them in computers and other storage media.

Teaching/Learning Resources

- Computers
- Network cables and accessories
- Scanner
- printer
- Modem
- Flash discs and CDs
- Wireless Internet connection

Sub-module 7: Working with Spreadsheets

Duration: 20 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • copies files and documents from one location to another. • emerges, deletes and inserts excel cells. • makes the spread sheets. • formats spreadsheet for printing. • prepares bills of quantities (accounts figures) using excel. • applies excel formulae in adding, multiplying, subtracting and dividing calculations. • draws charts and graphs using excel and Internet.	• 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	• Demonstrate the criteria of copying files and documents from one location to another and guide learners to practice. • Guide learners through the techniques of emerging, deleting, inserting excel cells and task them to practice. • Lead learners to draw excel bar charts, graphs and histograms • Demonstrate the preparation of the bill of quantities and guide learners to practice.

Assessment Strategies

Assign the learner to:

typeset the bill of quantities and perform all the calculation involved using excel formulae

Teaching/Learning Resources

- Computers
- Power generator
- Solar energy
- Flash discs and CDs
- Sample Bills of quantities
- graphs
- calendars
- Murray H. (2003). *Teach Yourself Basic Computer Skills*. New Edition; Teach Yourself Books.
- Raisi F. A.,(2011). *Basic Computer Skills*. 1st Edition; Sultan Qaboos, University College of Science.

TCAM 101: Automotive Technology and Maintenance I

Duration: 50 Hours

Module Overview

The module equips learners with the skill of troubleshooting the faults, repairing and maintaining a vehicle to good working condition.

Learning Outcome

By the end of this module, the learner should be able to mark out, measure, explain types of suspension systems, troubleshoot faults, repair and maintain the vehicle to good working condition.

Preparatory Assignment

Task learners to identify the marking out tools in the workshop and universal joints in a vehicle.

Result

Learners identify the universal joints.

Sub-module 8: Marking out Tools

Duration: 8 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • identifies the various types of marking out tools and selects them for use during marking out. • demonstrates	• Steel rule, squares, dividers • Hand scriber, scribing block and surface gauge • Angle plate	• Display the various types of marking out tools and task learners to identify them. • Guide learners through practice on how the different

Competences	Content	Teaching/Learning Strategies
how the different datum lines are used in measuring and marking out process. • demonstrates the method of using marking out tools. • demonstrates the Health , safety and security of environment when using marking out tools.	• V-blocks • Parallel strips or block • Spirit levels • Surface plate • Health, safety and security of marking out tools.	datum lines are used in measuring and marking out process. • Guide learners through practice on the method of using marking out tools • Demonstrate the health, safety and security of environment when using marking out tools.

Assessment Strategies

Assign the learner to identify the various types of marking out tools and select them for use during marking out.

Teaching / Learning Resources

- Slides and display charts
- Models
- Internet
- Marking out tools

Sub-module 9: Workshop Measuring Instrument

Duration: 6 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • identifies and selects the various workshop measuring instrument for use according to their function. • demonstrates the procedure of using measuring instruments. • ensures the health , safety and security of measuring instruments.	• Micrometer • Vanier calliper • English micrometer • Venire in English system • Health, safety and security of measuring instruments.	• Guide learners through practice how the selection of various workshop measuring instruments is done according to their function. • Guide learners through practice on the procedure of using each measuring instrument • Demonstrate how to ensure the health, safety and security of measuring instruments and let them practise.

Assessment Strategy

Assign the learner to select the various workshop measuring instruments for use according to their function.

Teaching / Learning Resources

- Slides and display charts
- Workshops gears
- Measuring instruments
- Work pieces.
- Models
- Internet

Sub-module 10: Screw Thread and Screw Cutting

Duration: 6 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • applies the various methods of cutting screw threads. • demonstrates the health and safety of environment when threading and cutting screws.	• Types of threads. • Methods of forming screw threads • Health and safety of environment when threading and cutting screws	• Guide learners through practice on the various methods of cutting screw threads and their application in industry. • Demonstrate how to ensure the health and safety of environment when threading and cutting screws.

Assessment Strategy

Assign the learner to apply the various methods of cutting screw threads.

Teaching / Learning Resources

- Chalk board/writing boards
- power point
- slides and display charts
- workshops gears
- measuring instruments
- work pieces
- models
- Internet

Sub-module 11: Drive Train

Duration: 10 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • locates the main components of the drive train and maintains them to their normal function. • applies the health and safety of environment when servicing the drive train.	• Universal joints and propeller shaft • Final drive • Drive axles • Servicing and maintenance of final drive. • Health , safety and security of vehicle and drive train	• Guide learners to locate the main components of the drive train. • Guide learners through practice on the maintenance of the main components of drive train to their normal function. • Guide learners on how to ensure the health and safety of the environment when servicing the drive train and allow them to practise.

Assessment Strategy

Assign the learner to locate the main components of the drive train and maintain them to their normal function.

Teaching /Learning Resources

- Chalk board/writing boards
- power point
- slides and display charts
- workshops gears
- models
- Internet
- Drive train components
- Running vehicle

Sub-module 12: Suspension Systems

Duration: 10 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • identifies the main components of the suspension system, Services and maintains it. • applies the health, safety and security of environment when servicing the suspension system.	• Types of suspension system and their operations; - beam axle suspension - independent suspension • Wheels and types • Servicing and maintenance of suspension system • Health, safety and security of suspension system.	• Guide the learners through practice to identify the main components of the suspension system. • Guide learners through practice on the procedure of servicing and maintaining the suspension system. • Guide learners on the Health, safety and security of environment when servicing the suspension system.

Assessment Strategies

Assign the learner to identify the main components of the suspension system, Service and maintain the suspension system.

Teaching / Learning Resources

- Chalk board/writing boards
- Power point
- Slides and display charts
- Workshops gears
- Tool box
- Running vehicle

Sub-module13: Steering System

Duration 10 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • describes the operation of the steering system and services and maintains the steering system components. • applies the health , safety and security of environment when servicing the steering system.	• Principle of steering system • Steering geometry • Types of steering systems • Steering system components • Servicing and maintenance of steering system components • Health, safety and security of environment when servicing the steering system.	• Lead guided discussion on the description of the operation of the steering system. • Guide the learners through practice on the procedure of maintaining the steering system components. • Guide learners on the health, safety and security of environment when servicing the steering system.

Assessment Strategy

Assign the learner to describe the operation of the steering system and maintain the steering system components.

Teaching / Learning Resources

- Chalk board/writing boards
- Power point
- Slides and display charts
- Workshops gears
- Models

- Internet
- Running vehicle
- Chapman, J. K.,(1983).Workshop Technology. 4th Edition; Macmillan Press Ltd.
- Gupta, G. K.(1985).*Workshop Technology*. 3rd Edition; Macmillan Press Ltd.
- Hillier, V.A.W.(1986). *Fundamentals of Motor Vehicle Technology*. 5th Edition; Macmillan press Ltd.
- Mudd,S.C., (1986).*Technology for Motor Mechanics*. 2nd Edition; Edward Arnold (publishers) Ltd.
- Pritchard, R. T., (1979).*Technician Workshop Processes and Materials.* 3rd Edition; Hodder and Stoughton Ltd.
- Stockel, M. W. and Stockel, M. T. (1984). *Auto service and Repair*. 4th Edition; Good Heart, Willicox Company, Inc

TCAM I02: Automotive Electric and Electronics Practice I

Duration: 30 Hours

Module Overview

The module enables learners to troubleshoot electrical faults, repair and maintain the electrical components of the vehicle. The module introduces the learner to the auto electrical and electronic systems.

Learning Outcome

By the end of this module, the learner should be able to identify the various parts of the starting system, describe the construction and operation of charging system, service and maintain the lighting systems of a vehicle.

Preparatory Assignment

Learners are given faulty starting systems and tasked to troubleshoot the faults.

Result

Learners troubleshoot the fault.

Sub-module 4: Starting System

Duration: 10 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • identifies the various parts of the starting system and maintains the	• Starter motor circuit • Starter engagement with engine	• Guide the learners through practice to identify the various parts of the starting system. • Guide learners through

Competences	Content	Teaching/Learning Strategies
main components. • applies the health , safety and security of environment when servicing the starting system.	• Axial and co-axial starter motors • Health, safety and security of environment when servicing the starting system.	practice on the procedure of maintaining the main components of the starting system. • Guide learners on the Health, safety and security of environment when servicing the starting system.

Assessment Strategy

Assign the learner to identify the various parts of the starting system and maintain the main components.

Teaching /Learning Resources

- Starter motor
- Axial and co-axial starter motors.
- Running vehicle
- Assorted spanners
- Screwdrivers
- Working drawing
- Working tables
- Circuit board

Sub-module 5: Charging System

Duration: 12 Hours

Competences	Content	Teaching/Learning Strategie
The learner: • describes the construction and operation of charging system , repairs and maintains the main components • observes the health, safety and security of environment when servicing the charging system. • draws and interprets the charging system regulator diagrams.	• Principles of charging system • Lay-out of charging system and operation • Alternator construction and operation • Rectification of AC currents • Charging system regulator diagrams • Rectification of AC currents and starting system • Health, safety and security of vehicle and the charging system.	• Lead a guided discussion on the description of the construction and operation of charging system. • Guide learners through practice on how to repair and maintain the main components of the charging system. • Guide learners on the health, safety and security of environment when servicing the charging system.

Assessment Strategy

Assign the learner to describe the construction and operation of charging system, repair and maintain the main components.

Teaching/Learning Resources

- Running vehicle
- Vehicle wiring board
- Wires
- Clips
- Connectors
- Assorted spanners
- Screw drivers
- Alternator

Sub-module 6: Lighting System

Duration: 8 Hours

Competences	Content	Teaching/Learning Strategie
The learner: • applies the method to service and maintain the lighting systems of a vehicle. • applies the health, safety and security of environme nt when servicing the lighting system.	• Circuit arrangements • Filament lamps • Auxiliary lighting and equipment • Health, safety and security of vehicle and lighting system.	• Guide learners through practice on the method of servicing and maintaining the lighting system of a vehicle. • Guide learners on the Health, safety and security of environment when servicing the lighting system.

Assessment Strategy

Assign the learner to service and maintain the lighting systems of a vehicle.

Teaching/Learning Resources

- Running vehicle
- Vehicle wiring board
- Wires, clips, connectors
- Assorted spanners
- Screwdrivers
- Hillier, V.A.W., (1986). *Fundamentals of Motor Vehicle Technology*. 5th Edition; Macmillan Ppress Ltd.
- Mudd, S.C., (1986). *Technology for Motor Mechanics.* 2nd Edition; Edward Arnold (publishers) Ltd.
- Stockel, M.W.and Stockel, M. T., (1984). *Auto Service and Repair*. 4th Edition; Good Heart,Willicox Company,Inc.

TCAM 103: Technician Science I

Duration: 40 Hours

Module Overview

The module equips learners with the skill of analysing the effect of force and heat on engineering materials as used in the sizing of materials for production.

Learning Outcome

By the end of this module, the learner should be able to analyze the effect of heat on engineering materials and the relationship between velocity, acceleration and braking efficiency in the sizing of materials for production.

Preparatory Assignment

Learners are given problems on temperature and heat to solve.

Result

Learners hand in their work for marking.

Sub-module 4: Temperature and Heat

Duration: 22 Hours

Competences	Content	Teaching/Learning Strategies
The learner calculates heat energy transfer and the related effect on the materials.	• Measurement of heat and temperature • Specific heat capacity • Latent and sensible heat • Heat transfer • Calorific value of heat • Coefficient of expansion	Illustrate how to calculate heat energy transfer and the related effect on the materials and let learners practise.

Assessment Strategy

Learner should be able to calculate heat energy transfer and the related effect on the materials.

Teaching/Learning Resources

- Chalkboard/ writing boards
- Power point
- Slides and display charts
- Calculator.
- Internet

Sub -module 5: Velocity, Acceleration and Braking Efficiency

Duration: 18 Hours

Competences	Content	Teaching/Learning Strategies
The learner determines the velocity, acceleration and braking efficiency of a vehicle.	• Speed and velocity • Relationship between distance, velocity, acceleration and time • Braking efficiency	Illustrate how to determine the velocity, acceleration and braking efficiency of a vehicle.

Assessment Strategy

Assign the learner to determine the velocity, acceleration and braking efficiency of a vehicle.

Teaching/Learning Resources

- Chalkboard/ writing boards
- Power point

- Slides and display charts
- Calculator.
- Edward, A. (1986). *Principles of Engineering Mechanics*. 2nd Edition; UK, Longman Group UK Ltd.
- Hannah, J. and Hillier, M. J. (1984). *Applied Mechanics*. 4th Edition; PITMAN Publisher Ltd.
- Zammit, S. J., (1987). *Motor Vehicle Engineering Science for Technicians*. 2ndEdition; UK, Longman Group UK Ltd.

TCAM104: Technical Drawing I

Duration: 40 Hours

Module Overview

The module equips learners with the skill of interpreting and drawing various engineering parts, which is also used as communication medium for production of engineering parts.

Learning Outcome

By the end of this module the learner should be able to interpret, draw correctly and construct various engineering parts which are used as communication media for production of engineering parts.

Preparatory Assignment

Before teaching this module, learners are given an isometric block and tasked to draw the plan.

Result

Learners draw the plan.

Sub-module 4: Loci and Helices

Duration: 18 Hours

Competences	Content	Teaching/Learning Strategies
The learner constructs common loci, helices and plots the loci for the link mechanisms.	• Common loci • Helices • Link – mechanism	Guide learners through practice on the construction of common loci, helices and the plotting of the loci for the link mechanisms.

Assessment Strategy

Assign the learner to construct common loci, helices and plots the loci for the link mechanisms.

Teaching / Learning Resources

- Chalk board/writing boards
- Computers
- Sample models
- Drawing instruments and equipment
- Drawing materials
- Slides and display charts
- Internet

Sub-module 5: Isometric Blocks and 1st Angle Orthographic Projection

Duration 22 Hours

Competences	Content	Teaching/Learning Strategies
The learner constructs pictorial views using isometric projections and draws views of isometric drawing in first angle orthographic projection.	• Isometric blocks • Elevations and Plan • Projection symbols • Dimensioning and Scaling	• Guide the learners through practice to construct pictorial views using isometric projections. • Guide learners through practice to draw views of isometric drawing in first angle orthographic projection.

Assessment Strategies

Assign the learner to construct pictorial views using isometric projections and draw views of isometric drawing in first angle orthographic projection.

Teaching / Learning Resources

- Chalk board/writing boards
- Computers
- Sample models
- Drawing instruments and equipments
- Drawing materials
- Slides and display charts
- Internet
- Pick Up and Parker, (1987).Engineering Drawing with Worked Examples.2nd Edition; UK ,Longman Group Ltd.
- Torrice, (1986).Technical Drawing for Today. 2nd Edition; UK, Longman Group Ltd.

TCAM 105: Real Life Project 1

Duration: 40 Hours

Module Overview

This module equips the learner with the practical skills in fabrication, drawings, forming/machining, joining, fitting, finishing and assembling various engineering components. This project equips the learner with practical skills in analysing design requirements, selection of materials, assembling of functioning systems, selecting troubleshooting methods, dismantling and assembling machine parts to their proper functioning.

Learning Outcome

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

- fabricate, draw, form/machine, join, fit, finish and assemble various engineering components.
- analyse designs, select materials, assemble functioning systems, select troubleshooting methods, dismantle and assemble machine parts to their proper functioning.
- observe health and safety and ensure security of the equipment during execution of project activities.

Preparatory Assignment

Before teaching this module, task learners with expert assignment at every stage of real life project (Initiation, Planning, Execution, Control and Closure stage).

Result

Learners do the expert assignment at every stage of real life project (Initiation, Planning, Execution, Control and Closure stage).

Competences	Content	Teaching/ Learning Strategies
The learner: • prepares and interprets engineering drawings. • identifies materials/tools and machines. • innovates and modifies components. • carries out shaping operations: filing, sawing, casting, forming, machining, tapping and dyeing. • carries out heat treatment of machine parts. • prepares and interprets engineering drawings. • identifies materials and tools. • innovates and modifies components. • selects the troubleshooting methods to identify the faults. • interprets the operation manuals. • identifies materials and consumables. • selects the tools and components. • dismantles and assembles machine parts. • sustains constant maintenance of the unit. • tests and operates the transmission system.	**Projects** • Tool box • Dust pan • Spanner • G-clamp • Screw jack • Gear box final drive overhaul • Design and wire on aboard a conventional lighting circuit • fabricate casement hinge • fabricate round charcoal stove using rivets • fabricate waste disposal units • fabricate axle stand • fabricate vehicle seat stand • fabricate vehicle rack • Repair tyres • Align wheels • spray / re-spray vehicle body NOTE: *The project(s) should be completed by the end of first year.*	• Guide learners through practice on the stages of producing the selected project beginning with simple expert example. • Demonstrate the health, safety and security measures during execution of project activities. • Guide learners on how to prepare project reports.

Competences	Content	Teaching/ Learning Strategies
• costs and quantifies materials. • assembles components. • tests the machine. • prepares project reports. • observes and ensures the health, safety and security measures during execution of project activities.		

Assessment Strategy

Assign the learner to fabricate a simple component or maintain an engine to good working condition.

Teaching / Learning Resources

- Writing board
- Instruments and equipments
- Safety standards.
- Project materials
- Tools
- Charts
- Models
- PowerPoint
- Internet
- Chapman, J. K. (1983). *Workshop Technology*. 4th Edition; Macmillan Press Ltd.
- Gupta, G. K(1985). *Workshop Technology*. 3rd Edition; Macmillan Press Ltd.
- Hillier, V. A. W. (1986). *Fundamentals of Motor Vehicle Technology*. 5th Edition; Macmillan press Ltd.
- Mudd, S.C. (1986). *Technology for Motor Mechanics*. 2nd Edition;, Edward Arnold (publishers) Ltd.

- Pritchard, R. T. (1979). *Technician Workshop Processes and Materials.* 3rd Edition; Hodder and Stoughton Ltd.
- Stockel, M. W. and Stockel, M. T. (1984). *Auto service and Repair*. 4th Edition; Good Heart Willicox Company, Inc

Description of Year I Term III

Code	Module Title (All Core Modules)	Total Hours	Hours Per Week
TCTM 101	Applied Technician Mathematics I	32	4
TCCS 101	Life skills	16	2
TCCA 101	Computer Application	32	4
TCAM 101	Automotive Technology and Maintenance I	40	5
TCAM 102	Automotive Electric and Electronics Practice I	24	3
TCAM 103	Technician Science I	32	4
TCAM 104	Technical Drawing I	32	4
TCAM 105	Real Life Project I	32	4
TOTAL		**240**	**30**
RECESS TERM			
TCAM 111 Industrial Training (10 Weeks on Avera		480	48

TCTM 101: Applied Technician Mathematics I

Duration: 40 Hours

Module Overview

The module introduces learners to the concepts of complex numbers and vectors algebra. It equips the learner with the skills of representing numbers in polar form, graphical and imaginary.

Learning Outcomes

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

- solve equations involving complex numbers.
- evaluate vectors.

Preparatory Assignment

Give learners complex numbers and vectors to search for solutions.

Result

Learners search for solutions of the given assignment and present the findings in the class.

Sub-module 6: Complex Numbers

Duration: 16 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • represents the identities applied in complex numbers. • adds and subtracts	• Equal complex numbers. • Graphical representation of complex number.	• Demonstrate the representation of complex number identities • Guide learners through the evaluation and

Competences	Content	Teaching/ Learning Strategies
complex numbers. • manipulates equal, polar and exponential forms equations of complex numbers. • graphically represents complex numbers to standard forms.	• Polar form of complex number • Exponential form of a complex number.	manipulation of complex numbers. • Illustrate the techniques of graphical, polar and exponential representation of complex numbers and guide learner to practice. • Lead learners through practice to manipulate the addition and subtraction of complex numbers.

Assessment Strategy

Assign the learner to add and subtract complex number.

Teaching/Learning Resources

- Scientific calculator
- Mathematical set
- Hard board
- Graph papers
- Log table

Sub-module 7: Vectors

Duration: 16 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • manipulates equations involving vectors, by addition, subtraction and multiplication. • represents vectors on graphs.	• Introduction to vector representation • Types of vectors • Manipulation of vectors. - Addition - Subtraction	• Guide learners to practise the representation of vectors on graphs. • Using example illustrate the types of vectors. • Through practice illustrate the addition, subtraction and multiplication of vectors.

Assessment Strategy

Assign the learner to add, subtract and multiply vectors.

Teaching/Learning Resources

- Scientific calculator
- Mathematical set
- Hard board
- Graph papers
- Log table
- Bird, J. O. and May, A.J.C.,(1982).*Technician Mathematics*. 3rd Edition; Longman.
- Stroud, K. A. (1995). *Engineering Mathematics*. 4th Edition; Macmillan Press Ltd.
- Backhouse, (1985). *Pure Mathematics*. 4th Edition; Longman.

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 how to create public awareness on the impact and interventions to combat HIV and AIDS.

Learning Outcomes

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.

Preparatory Assignment

- Ask 5 volunteers who have ever nursed an AIDS patient, lost someone to AIDS or are HIV positive to share their experiences with the other learners non discriminately
- The rest of the learners pay attention to the shared scenarios.
- The teacher guides the learners' reactions as the volunteers are sharing their experiences.
- Teacher draws lessons learnt from the shared testimonies.

Results

- The learners make presentations from their discussion and clarify on the presentation.
- The learners appreciate and express emotional, social and economic impact of HIV and AIDS

Sub-module 7: Oral Communication Skills and HIV and AIDS Education

Duration: 06 Hours

Competences	Content	Teaching/ Learning Strategies
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.	• Listening and speaking • Conducting meetings and interviews • Phone messaging • Customer care language	• Lead a guided discussion on the basic listening skills, barriers to effective listening, importance of voice variation and clarity in public speaking. • Demonstrate the skill and technique of varying voice and clarity in public speaking. • Arrange for a meeting with the class, ask learners to elect the chairperson, and secretary to discuss the roles and suggest an agenda for the meeting as: prayer, adoption of agenda and introduction, communication from the chair, reactions and way forward, and closure. • Illustrate the writing of legal and official minutes, outlining the responsible person, the action and minute numbering.

Assessment Strategies

Assign the learner to:

- organise a class meeting, elect the chair and secretary, and adopt an agenda for the meeting.

- write minutes for the class meeting and include the attendance list of all the members present, absent with apologies and those members absent without apologies.

Teaching/Learning Resources

- Sample news papers
- Sample public speech
- Sample legal minutes

Sub-module 8: Working Environment

Duration: 04 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • educates public on importance of upholding good labour laws and good safety and health conditions at work. • describes good labour laws and good safety and health conditions at work place and homes. • practises good labour laws and good safety and	• Labour laws and regulations • Health and safety • Environment • Gender and mainstreaming of gender • Population growth / trends • Human rights • Social structure Economic structure	• Lead a guided discussion on good labour relations and good safety and health conditions at home and work place. • Task learners to demonstrate good safety and health conditions at home and work place. • Guide learners in presenting a play on bad labour laws where an employee is sacked out of job by the employer's wish and has nowhere to get help from. The effects of losing a job and getting stranded, emphasising the need

Competences	Content	Teaching/ Learning Strategies
health.		to create one's own job/enterprise. • Guide learners to formulate and observe good safety and health conditions and discuss the benefits.

Assessment Strategies

Assign the learner to:

- organise and conduct a role play on some of the employers' bad behaviour of chasing employees and its effects.
- conduct a role play on good safety and health working conditions at home and work place.

Teaching/Learning Resources

- Sample newspapers for stories and news related to labour laws
- Safety and health chats
- Police precautions on risky unsafe behaviours

Sub-module 9: Impact and Interventions of HIV and AIDS

Duration: 6 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • 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 and AIDS in the families, communities and the country.	• Impact of HIV and AIDS • Interventions to combat HIV and AIDS • Counselling and testing • Treatment, care and support • Mitigation of stigma and discriminatio n • Disclosure of HIV status • HIV and AIDS workplace policy for Uganda	• Lead a guided discussion on VCT treatment and care and impact of HIV and AIDS. • Guided to discuss the qualities of a good counsellor • Demonstrate the skills required during counselling sessions and task learners to role play the qualities of a good counsellor. • Take learners to the nearest HIV and AIDS care centre and task them to chat and share testimonies with patients, make a report in groups and present to the class.

Assessment Strategies

Assign the learner to:

- organise and act a role play on the qualities of a good counsellor, his/her approaches to clients and the ethical character.
- write on impact of HIV and AIDS to families, the country, financially.

Teaching/Learning Resources

- The Internet
- Documentaries
- *Uganda Constitution*
- *Human Rights Handbook*
- *Public Service Act 1998 Revised*
- *Prevention of AIDS Hand Book* by Uganda AIDS Commission

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 one printer.

Preparatory Assignment

Prior to teaching the learners this module, take learners to any Internet cafe or computer lab and guide them on criteria used to connect two or more computers together to share one printer.

Result

Learners observe the local area network connections and take note of the criteria and accessories used for the connections.

Sub-module 8: Power Point Presentations

Duration: 14 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • prepares work on Ms PowerPoint slides. • edits the work on slides.	• Creating a new presentation • Opening and closing a presentation • Saving a presentation	• Lead a guided discussion on the importance and application of PowerPoint presentations. • Demonstrate the

Competences	Content	Teaching/ Learning Strategies
• activates animations on the selected slide design. • makes a PowerPoint presentation . • runs a full slide show.	document • Transferring a presentation to a storage media and different formats • Adding and formatting text, pictures and media • Creating a slideshow and running a slideshow • Printing presentation slides	procedure of preparing work on Ms PowerPoint and assign the learners to prepare their CVs on slides ready to be presented. • Guide learners through the techniques applied to edit slides and activate animations on slides. • Demonstrate how a PowerPoint presentation slide is run and formatted and task learners to practise.

Assessment Strategy

Assign the learner to prepare his/her CV on slides, activate slide animations and present the CV on PowerPoint.

Teaching/Learning Resources

- Computers
- Overhead projector
- Sample CVs
- Power generator

Sub-module 9: Basic Networking

Duration: 18 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • differentiates between wireless and cable networking. • connects a network cable to computers. • installs network modem to a pc. • troubleshoots simple network connection problems.	• 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	• Lead a guided discussion on identification of topologies, difference between wireless and cable networking. • Demonstrate the procedure of networking and guide learners to practise. • Guide learners through practice on the installation and uninstallation of a network computer and modem. • Demonstrate how two or more computers are configured to share one printer and task learners to practise.

Assessment Strategies

Assign the learner to:

- network and configure two computers to share one printer.
- install and uninstall the network computer modem.

Teaching/Learning Resources

- Two or more working computers
- Working printer
- Network cables
- Wireless network system
- Network modems
- Screws
- Cable pins/holders
- Other assorted accessories

TCAM 101: Automotive Technology and Maintenance I

Duration: 40 Hours

Module Overview

The module equips learners with the skill of troubleshooting faults, repairing and maintaining vehicle in good working condition.

Learning Outcome

By the end of this module, the learner should be able to identify the main components of braking system of vehicle and maintain them, service and maintain the main parts of the motor cycle, describe the engine construction and overhaul an engine, join materials using different welding methods and identify different forging tools used in the repair and maintenance of a vehicle.

Preparatory Assignment

Before teaching this module, Learners are given a motor vehicle and tasked to overhaul the engine.

Result

Learners overhaul the engine.

Sub-module 14: Simple Welding

Duration: 8 Hours

Competences	Content	**Teaching/Learning Strategies**
The learner: • applies various welding methods to join materials. • applies the	• Soldering • Brazing • Gas welding • Manual arc welding	• Guide the learners through practice in the use of various welding methods to join materials.

Competences	Content	Teaching/Learning Strategies
health , safety and security of welding machines and environment during practice.	• Health, safety and security of welding machines and environment	• Demonstrate to learners how to ensure the health, safety and security of welding machines and environment during practice.

Assessment Strategy

Assign the learner to use various welding methods to join materials.

Teaching / Learning Resources

- Two or more working computers
- Working printer
- Network cables
- Wireless network system
- Network modems
- Modern computers for today text book
- Screws
- Cable pins/holders
- Other assorted accessories

Sub- module 15: Forging

Duration: 6 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • identifies various forging tools and uses them to forge various parts. • observes the	• Forging tools • Forge work. • Drop forging • Health,	• Display various forging tools and task learners to identify them. • Guide the learners through practice how to use forging tools to forge various parts.

Competences	Content	Teaching/Learning Strategies
health, safety and security of foundry equipment and environment during practice.	safety and security of foundry equipment and environment	• Demonstrate how to observe and ensure the health, safety and security of foundry equipment and environment during practice.

Assessment Strategy

Assign the learner to identify various forging tools and use them to forge various parts.

Teaching / learning Resources

- Two or more working computers
- Working printer
- Network cables
- Wireless network system
- Network modems
- Modern computers for today textbook
- Screws
- Cable pins/holders
- Other assorted accessories

Sub- module 16: Braking System

Duration: 12 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • identifies the main components of braking system of a vehicle and maintains them	• Simple braking system • Disc brakes • Drum brakes • Brake	• Guide learners through practice on how to identify the main components of braking system of a vehicle and maintain

Competences	Content	Teaching/Learning Strategies
to their proper function. • ensures the health , safety and security of braking system and the environment during practice.	operating systems and components • Health, safety and security of braking system and the environment	them to their proper function. • Guide learners on how to ensure the health, safety and security of braking system and the environment during practice.

Assessment Strategy

Assign the learner to identify the main components of braking system of vehicle and maintain them to their proper function.

Teaching / Learning Resources

- Running vehicle model
- Old vehicle
- Spanners
- Working tables
- Disc assembly unit
- Water
- Drum brake assembly
- Brake fluid
- Heavy vehicle
- Light comm. vehicle

Sub-module 17: Motor Cycles

Duration: 14 Hours

Competences	Content	Teaching/Learning Strategies
The learner • services and	• Types of motor cycles	• Guide learners through practice on the

Competences	Content	**Teaching/Learning Strategies**
maintains the • main parts of the motorcycle. • demonstrates the • procedure of overhauling a vehicle engine. • observes the health , safety and security of motorcycles and the environment during practice.	• Power unit • Drive train • Frame and suspension • Brakes • Wheels and tyres • Electrical system • Vehicle Engine overhaul • Health, safety and security of motor cycles and the environment	procedure of servicing and maintaining the main parts of the motorcycle. • Guide learners through practice on the procedure of overhauling a vehicle engine. • Guide learners on how to ensure the health, safety and security of motor cycles and the environment during practice.

Assessment Strategies

Learner should be able to:

- service and maintain the main parts of the motor cycle.
- overhaul a vehicle engine.

Teaching/Learning Resources

- Complete running vehicle
- Motor cycle
- Engine
- Power trains
- Wheels
- Tyres
- Model
- Battery
- Starter
- Frame
- Suspension
- Shoe linings
- Pads
- Brake fluid
- Water
- Cotton waste
- Oil
- Petrol
- Grease
- Tubes
- Hub (front and rear)
- Petrol engine
- Diesel engine

- Chapman, J. K. (1983).Workshop Technology. 4th Edition; Macmillan Press Ltd.
- Gupta, G. K.(1985).*Workshop Technology*. 3rd Edition; Macmillan Press Ltd.
- Hillier, V.A.W(1986). *Fundamentals of Motor Vehicle Technology*. 5th Edition; Macmillan press Ltd.
- Mudd, S.C. (1986). *Technology for Motor Mechanics*. 2nd Edition; Edward Arnold (publishers) Ltd.
- Pritchard, R. T. (1979). *Technician Workshop Processes and Materials*. 3rd Edition; Hodder and Stoughton Ltd.
- Stockel, M. W.and Stockel, M. T. (1984). *Auto service and Repair*. 4th Edition; Good Heart Willicox Company, Inc

TCAM I02: Automotive Electric and Electronics Practice I

Duration: 24 Hours

Module Overview

The module enables learners to troubleshoot electrical faults, repair and maintain the electrical components of the vehicle.

Learning Outcome

By the end of this module, the learner should be able to identify the various parts of the electrical auxiliaries, troubleshoot electrical faults, repair and maintain the electrical components of the vehicle.

Preparatory Assignment

Before teaching this module, learners are given a motor vehicle and tasked to adjust drum brakes on tightness.

Result

Learners adjust drum brakes on tightness.

Sub- module 7: Electrical Auxiliaries

Duration: 24 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • identifies the various parts of the electrical auxiliaries and maintains the main components. • observes the health , safety	• Wiper mechanism • Hones and related wiring • Radio installation • Health, safety and security of	• Guide learners through practice on how to identify the main components of electrical auxiliaries of a vehicle and maintain them to their proper function. • Demonstrate how to

Competences	Content	Teaching/Learning Strategies
and security of electrical auxiliaries and environment during practice.	electrical auxiliaries and environment	observe the health, safety and security of electrical auxiliaries and environment during practice.

Assessment Strategy

Assign the learner to identify the main components of braking system of vehicle and maintain them to their proper function.

Teaching / Learning Resources

- Running vehicle model
- Old vehicle
- Spanners
- Working tables
- Disc assembly unit
- Water
- Drum brake assembly
- Brake fluid
- Heavy vehicle
- Light common vehicle

Teaching and Learning Resources

- Complete running vehicle
- Internet
- Hillier, V.A.W., (1986). *Fundamentals of Motor Vehicle Technology*. 5th Edition; Macmillan press Ltd.
- Mudd, S.C., (1986).*Technology for Motor Mechanics*. 2nd Edition; Edward Arnold (publishers) Ltd.
- Stockel, M.W and Stockel, M. T., (1984). *Auto Service and Repair*. 4th Edition; Good Heart Willicox Company,Inc.

TCAM 103: Technician Science I

Duration: 32 Hours

Module Overview

The module equips learners with the skill of analysing the effect of applied force on simple machines and the properties of gases in a system.

Learning Outcome

By the end of this module, the learner should be able to analyse the effect of applied force on simple machines and the properties of gases in a system.

Preparatory Assignment

Before teaching this module, task the learners to determine the work done by simple machines.

Result

Learners determine the work done by simple machines.

Sub-module 6: Simple Machines

Duration: 14 Hours

Competences	Content	Teaching/Learning Strategies
The learner : • determines the work done by simple machines and uses it to select the most effective machine to perform	• Simple machines terminologies • Limiting efficiency of a machine. • Simple machine tests • Hydraulic	• Illustrate how to determine the work done by simple machines and use it to select the most effective machine to perform specific tasks. • Guide learners

Competences	Content	Teaching/Learning Strategies
specific tasks. • operates a hydraulic pressure jack.	pressure and jack • Law of machines	through practice on how to operate a hydraulic pressure jack.

Assessment Strategies

Assign the learner to determine the work done by simple machines and uses it to select the most effective machine to perform specific tasks.

Teaching/Learning Resources

- Calculator.
- Charts
- Projectors.
- Hydraulic jack

Sub-module 7: Properties of Gases

Duration:18 Hours

Competences	Content	Teaching/Learning Strategies
The learner determines the properties of gases in a working process.	• Absolute temperature and pressure • Boyle's and Charles' law • Compression ratio • Specific heat of gases • Adiabatic and isothermal expansion	Illustrate how to determine the properties of gases in a working process.

Assessment Strategy

Assign the learner to determine the properties of gases in a working process.

Teaching / Learning Resources

- Calculator
- Charts
- Projectors
- Edward, A., (1986). *Principles of Engineering Mechanics*. 2nd Edition; UK, Longman Group UK Ltd.
- Hannah, J. and Hillier, M. J. (1984). *Applied Mechanics*. 4th Edition; PITMAN Publisher Ltd.
- Zammit S. J., (1987). *Motor Vehicle Engineering Science for Technicians.* 2ndEdition; UK, Longman Group UK Ltd.

TCAM 104: Technical Drawing I

Duration: 32 Hours

Module Overview

The module equips learners with the skill of interpreting and drawing various engineering parts which are used as communication media for production of engineering parts.

Learning Outcome

By the end of this module the learner should be able to interpret and draw accurately various engineering parts which are used as communication media for production of engineering parts.

Preparatory Assignment

Prior to teaching this module, give learners a drawing in first angle orthographic projection and tasks them to draw it in third angle orthographic projection.

Result

Learners draw it in third angle orthographic projection.

Sub-module 6: Orthographic Projection

Duration- 20 Hours

Competences	Content	Teaching/Learning Strategies
The learner draws, accurately, views from isometric objects in third angle orthographic projections.	**3rd** angle projection	Guide learners through practice on how to draw views from isometric objects in third angle orthographic projections.

Assessment Strategy

Assign the learner to accurately draw views from isometric objects in third angle orthographic projections.

Teaching / Learning Resources

- Drawing papers
- Drawing instruments
- Drawing board
- Working tables
- Pencils
- Rubber
- Calculator
- Razorblade
- Pencil sharpener
- Ruler

Sub-module 2: Principle of Sectioning

Duration: 12 Hours

Competences	Content	Teaching/Learning Strategies
The learner illustrates various types of sections and draws accurately sectional views of objects.	• Various Sections • Sectional views	• Illustrate the various types of sections. • Guide learners through practice on how to draw accurately sectional views of objects.

Assessment Strategies

Assign the learner to construct pictorial views using isometric projections and draw views of isometric drawing in first angle orthographic projection.

Teaching / Learning Resources

- Chalk board/writing boards
- Computers
- Sample models
- Drawing instruments and equipment
- Drawing materials
- Slides and display charts
- Internet
- Pick Up and Parker, (1987).*Engineering Drawing with Worked Examples.* 2nd Edition; UK, Longman Group Ltd.
- Torrice, (1986).*Technical Drawing for Today*. 2nd Edition; UK, Longman Group Ltd.

TCAM 105: Real Life Project I

Duration: 32 Hours

Module Overview

This module equips the learner with the practical skills in fabrication, drawings, forming/machining, joining, fitting, finishing and assembling various engineering components. This project equips the learner with practical skills in analysing design requirements, selecting materials, assembling functioning systems, selecting troubleshooting methods, dismantling and assembling machine parts to their proper functioning.

Learning Outcome

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

- fabricate, draw, form/machine, join, fit, finish and assemble various engineering components.
- analyse design, select materials, assemble functioning systems, select troubleshooting methods, dismantle and assemble machine parts to their proper functioning.
- observe health and safety and ensure security of the equipment during execution of project activities.

Preparatory Assignment

Before teaching this module, task learners with expert assignment at every stage of real life project.

Result

Learners do the expert assignment at every stage of real life project.

Competences	Content	Teaching/Learning Strategies
The learner; • prepares and interprets engineering drawings.	**Projects** • Cylinder head overhaul	• Guide learners through practice on the stages of

Competences	Content	Teaching/Learning Strategies
• identifies materials/tools and machines. • innovates and modifies components. • carries out shaping operations: filing, sawing, casting, forming, machining, tapping and dyeing. • carries out heat treatment of machine parts. • prepares and interprets engineering drawings. • identifies materials and tools. • innovates and modifies components. • selects the troubleshooting methods to identify the faults. • interprets the operation manuals. • identifies materials and consumables. • selects the tools and components. • dismantles and assembles machine parts. • sustains constant maintenance of the unit. • tests and operates the	• Engine overhaul • Engine tuning after overhaul. • Design and wire on a board electrical auxiliaries • Water pump service • Fabricate casement hinge • Fabricate round charcoal stove using rivets • Fabricate waste disposal units • Fabricate axle stand • Fabricate vehicle seat stand • Fabricate vehicle rack • Repair tyres • Align wheels • Spray / re-spray vehicle body • Fabricate toolbox • Fabricate dust pan • Fabricate spanner • Fabricate G-clamp	producing the selected project beginning with simple expert example. • Demonstrate to the learner how to observe health, safety and ensure security of the equipment during execution of project activities.

Competences	Content	Teaching/Learning Strategies
transmission system. • costs and quantifies materials. • assembles components. • tests the machine. • prepares project reports. • demonstrates health, safety and ensures security of the equipment during execution of project activities.	• Fabricate screw jack • Gear box final drive overhaul • Design and wire on aboard a conventional lighting circuit NOTE: *The project(s) should be completed by the end of first year.*	

Assessment Strategy

Assign the learner to fabricate a simple component or maintain engines in good working condition.

Teaching / Learning Resources

- Writing board
- Instruments and equipment
- Safety standards
- Project materials
- tools
- Charts
- Models
- PowerPoint
- Internet
- Chapman, J. K., (1983).*Workshop Technology*. 4th Edition; Macmillan Press Ltd.
- Gupta, G. K., (1985).*Workshop Technology*. 3rd Edition; Macmillan Press Ltd.

- Hillier, V.A.W., (1986). *Fundamentals of Motor Vehicle Technology*. 5th Edition; Macmillan Press Ltd.
- Mudd, S.C., (1986). *Technology for Motor Mechanics*. 2nd Edition; Edward Arnold (publishers) Ltd.
- Pritchard, R. T., (1979). *Technician Workshop Processes and Materials*. 3rd Edition; Hodder and Stoughton Ltd.
- Stockel, M. W. and Stockel, M. T., (1984). *Auto Service and Repair*. 4th Edition; Good Heart Willicox Company, Inc.
- Pick Up and Parker, (1987). *Engineering Drawing with Worked Examples.* 2nd Edition; UK, Longman Group Ltd.
- Torrice, (1986). *Technical Drawing for Today.* 2nd Edition; UK, Longman Group Ltd.

TCAM 111: Industrial Training I

Duration: 288 Hours (6 Weeks on Average)

Module Overview

The project involves attachment to sites/industries, and practical training in motor vehicle mechanics.

Learning Outcome

By the end of year one the learner should be able to perform corrective tasks on faulty motor vehicles, write and make a presentation on industrial work, familiarise with equipment and tools ,acquire skills in repair, maintenance of motor vehicles , plants, and maintain and repair tools and machines, observe health and safety and ensure security of the equipment

Preparatory Assignment

The learners are given questions in groups about industrial training.

Result

Learners hand in the answers for corrections.

Sub-module 1: Industrial Training

Duration 288 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • observes safety. • follows instruction. • dresses protectively. • measures and	• Acquaintance with Industry and sites • Familiarisation with equipment, tools and	• Lead a guided discussion on importance of IT: - who to do IT - when to do IT

Competences	Content	Teaching/Learning Strategies
cuts as required. • reads and interprets manuals. • develops sketches and working drawing. • interprets drawing. • troubleshoots and assesses the problem at hand. • selects the recommended spare parts. • costs the labour of the job done. • records daily record of work and progress. • drafts IT report. • manages environment. • observes health and safety and ensures security of the equipment during IT.	industries • Acquisition of skills in repair, maintenance of motor vehicles and plants • Health, safety and security of equipment.	- how to do IT • Write introduction letters for trainees to the industry. • Compile lists of trainees for IT. • Pay visits to industry/sites. • Make budget for transport and any necessary items for the visits. • Prior to start of industrial training sensitise students on the good health and safety practices in industry.

Assessment Strategies

Assign the learner to:

- describe the importance of industrial training ,who to do it, how to do it.
- receive letters for trainees to the industry.
- report for IT.

- make daily record of work at site /industry.
- report to immediate supervisor.
- attend meetings.
- sign daily attendance book at reception.

Teaching / Learning Resources

- Industry
- Sites
- Working station
- Office
- Classroom
- Newspapers
- Journals
- Business cards
- Students identity cards
- Introductory letters
- Assorted tools and equipment
- Protective wears

Description of Year 2 Term 1

Code	Module Title	Total Hours	Hours Per Week
TCTM 201	Applied Technical Mathematics II	40	4
TCBE 201	Entrepreneurship Skills	30	3
TCCS 201	Basic Kiswahili	20	2
TCAM 201	Automotive Technology and Maintenance II	50	5
TCAM 202	Automotive Electric and Electronic Practice II	40	4
TCAM 203	Technician Science II	30	3
TCAM 204	Technical Drawing II	40	4
TCAM 205	Real life Project II	40	4
Total		**290**	**29**

TCTM 201: Applied Technician Mathematics II

Duration: 40 Hours

Module Overview

The module introduces learners to elementary polynomials and binomial theorem, their application and importance in production industry.

Learning Outcome

By the end of this module, the learner should be able to calculate the magnitudes of the projects and thus delivering accurate estimates of not only costs but also time required to construct them.

Preparatory Assignment

Before teaching this module, give learners to determine the opposite side of a right angled triangle, if the adjacent and hypotenuse sides are known and given.

Results

Learners discuss the methods that can be applied to find the unknown opposite side, work out the solution and submit for marking in groups.

Sub-module 1: Expressions of Equations

Duration: 12 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • evaluates independent variables. • transposes	• Evaluating expressions • Equations • Evaluating	• Lead a guided discussion on evaluation of expression.

Competences	Content	Teaching/ Learning Strategies
various formulae. • applies the transposition of formulae in manipulating and solving production related problems.	independent variables • Transposition of formulae	• demonstrate the techniques applied when transposing formulae and task learners to practise. • Guide learners to practise the different methods of evaluating independent variables.

Assessment Strategies

Assign the learner to:

- transpose formulae.
- evaluate independent variables.

Teaching/Learning Resources

- Scientific calculator
- Mathematical set
- Hard board
- Graph papers
- Log table

Sub-module 2: Polynomial Equations

Duration: 14 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • factorises quadratic equation. • solves	• Polynomial expression, equations of polynomials	• Lead a guided discussion on application of polynomial

Competences	Content	Teaching/ Learning Strategies
polynomial equations by applying the reminder theorem. • solves general polynomial equations.	• Remainder theorem. • Factorisation of quadratic polynomials.	equations. • Guide learners to practise evaluation of polynomial equations by applying the reminder theorem. • Illustrate the factorisation of quadratic polynomials and task learners to practise.

Assessment Strategy

Assign the learner to evaluate and solve polynomial equations.

Teaching/Learning Resources

- Scientific calculator
- Mathematical set
- Hard board
- Graph papers
- Log table

Sub-module 3: Binomial Theorem

Duration: 14 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • expresses binomial theorem on Pascal's triangle.	• Expansion of binomial expressions: Pascal's triangle, the	• Illustrate the expression of binomial theorem on Pascal's triangle and task learners to

Competences	Content	**Teaching/ Learning Strategies**
• manipulates binomial theorem equations.	binomial theorem for 'n' a positive integer. • The general binomial expansion$(1+x)^n$ for 1 x 1 <1 and for 1 x 1 > 1	practise. • Guide learners in manipulating the general binomial expansion $(1+x)^n$ for 1 x 1 <1 and for 1 x 1 > 1

Assessment Strategies

Assign the learner to:

- express binomial theorem and Pascal's triangle.
- manipulate the general binomial expansion(1+x)n for 1 x 1 <1 and for 1 x 1 > 1.

Teaching/Learning Resources

- Scientific calculator
- Mathematical set
- Hard board
- Graph papers
- Log table
- Bird J. O. and May, A.J.C.,(1982). *Technician Mathematics*. Longman Higher Education Publisher
- Stroud K. A., (1995). *Engineering Mathematics*. 4th Edition,Macmillan Press
- Elhance, D.N., and Aggarwal, B. M. (2000). *Fundamental of Statistics.* New Delhi, Kitab Mahal.
- Backhouse, (1985). *Pure Mathematics*. 4th Edition, Longman.

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:

- exhibit the qualities of an entrepreneur.
- conduct a feasibility study for the projected business.
- design a business plan.

Preparatory Assignment

Obtain a story from the newspaper, Internet, or a profile of a prominent personality who started business from scratch. In groups allow learners to read through the story and identify key issues that led to the success of the entrepreneur. The groups should also come up with similar stories from their localities.

Result

Learners get an insight into entrepreneurial activities and develop the urge to engage in business.

Sub-module 1: Introduction to Entrepreneurship

Duration: 03 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • differentiates entrepreneurship from ordinary business ventures. • exhibits qualities of a good entrepreneur. • practises entrepreneurial ethics.	• Meaning of entrepreneurship • Qualities of an entrepreneur • Entrepreneurial ethics	• Guide learners' discussion in reference to their group reports, presentations, and experiences from the success story on the preparatory assignment; to develop their understanding of entrepreneurship, qualities of a successful entrepreneur and ethical business behaviour. • Assign learners tasks to identify entrepreneurial gaps in their communities by observing the major business practices and making comparative analysis. • Allow learners to participate in community business activities that will help them build and nurture their entrepreneurial skills.

Assessment Strategy

Assign the learner to identify factors affecting the development of entrepreneurs in communities, at home or place of work.

Teaching/Learning Resources

- The Internet
- Newspapers, business journals, magazines
- Biographies
- Television set, videos
- Billboards

Sub-module 2: Environmental Analysis

Duration: 10 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • scans the environment for business opportunities. • generates ideas for the business. • selects a viable business idea. • obtains business rights.	• Meaning of environment • Scanning the environment for Business opportunities • Generating business ideas • Evaluation and selection of business ideas • Protection of business (Trademark and patent rights)	• Guide learners to brainstorm the meaning of environment and the business opportunities available in their localities. • Display photographs or screen a video showing different environments and task learners in groups to identify the possible business opportunities available. Let them list their findings and make presentations from which real opportunities can be developed. • Using field work, divide learners in groups and

Competences	Content	Teaching/ Learning Strategies
		take them to the nearby community. Task them to discuss the identified business opportunities and evaluate them and come up with the most viable. • Invite a guest speaker to guide learners on protecting business ideas and products.

Assessment Strategy

Assign the learner to:

- identify a business opportunity in the environment.
- generate business ideas and select the most viable.

Teaching/Learning Resources

- The Internet
- Newspapers, business journals, magazines
- Biographies
- Television, videos
- Billboards
- Statutes/Laws
- Guest speaker
- Computers and projectors

Sub-module 3: Innovation and Creativity

Duration: 04 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • identifies the characteristics of innovativeness and creativity. • identifies forces of innovation. • devises means of overcoming barriers to creative thinking.	• Meaning of innovation and creativity • Characteristics of innovative and creative persons • Forces of innovation • Barriers to creativity and innovation	• Guide learners through a discussion on innovation and creativity in business. • Lead learners to brainstorm on the characteristics of creative and innovative entrepreneurs. • Task learners to discuss forces that hinder innovativeness and creativity. • Invite a successful entrepreneur to motivate learners to develop a culture of innovativeness and creativity in their daily encounters.

Assessment Strategy

Assign the learner to:

- identify innovations in a trade and give the possible forces that could have led to the innovation.
- suggest ways of overcoming barriers to creativity and innovation.

Teaching/Learning Resources

- The Internet
- Newspapers, business journals, magazines

- Biographies
- Television set, videos
- Billboards
- Statutes/Laws
- Guest speaker
- Computers and projectors

Sub-module 4: Business Planning

Duration: 09 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • selects the most appropriate form of small business enterprise to operate. • prepares a simple business plan. • prepares a simple budget for the business.	• 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	• Guide learners to discuss the forms of small business ownership. • Lead learners to brainstorm the importance of planning and budgeting before one embarks on any activity. • Using a sample business plan, guide learners to discuss the various parts of a business plan and its importance. • Group learners according to their trades and guide them to write a business plan for the identified opportunities and make presentations. • Illustrate the making of a simple budget using the business opportunities identified in the business plan.

Assessment Strategy

Assign the learner to:

- identify the benefits and challenges of small business enterprises.
- make a simple business plan.
- make a simple budget for the projected business.

Teaching/Learning Resources

- The Internet
- Newspapers, business journals, magazines
- Television set, videos
- Computers and projectors
- Simple business plan and budget templates

Sub-module 5: Implementing a Business Plan

Duration: 04 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • registers a business. • mobilises resources for starting a business. • locates a business in a suitable environment.	• Registering a Sole proprietorship and Partnership • Mobilising business resources - Financial resources - Human resources - Plant, machinery and	• Prepare a role play on the registration process of a sole-proprietorship and partnership by the "registrar of companies" bringing out the meaning and the requirements for registration. • Illustrate the process of registering a business locally and nationally • Group learners into their trades to identify the following tasks:

Competences	Content	Teaching/ Learning Strategies
	equipment • Locating a business	- available sources of finance to raise the capital for the business. - required personnel as per the business plan. - required assets for the business. • Take learners for a field visit to identify factors that led to location of different business enterprises.

Assessment Strategy

Assign the learner to:

- describe the process of registering a small business enterprise.
- describe the factors that influence the location of small business enterprises.

Teaching/Learning Resources

- The Internet
- Newspapers, business journals, magazines
- Computers and projectors
- Simple business plan and budget templates
- Sample Town plan
- Environmental statutes

TCCS 201: Basic Kiswahili

Duration: 20 Hours

Module Overview

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

Learning Outcome

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

Preparatory Assignment

Task learners to write and discuss the greetings in Kiswahili, in groups, and present in the class

Result

The learners write down the greeting in Kiswahili and present in class.

Sub-module 1: Introduction to Kiswahili

Duration: 2 Hours

Competence(s)	Content	Teaching/ Learning Strategies
The learner communicates using Kiswahili language.	• Origin and widespread of Kiswahili • Importance of Kiswahili to Ugandans and other East African countries	• Lead a guided discussion on the origin of Kiswahili and the factors that made it spread. • Using East African countries as an example, lead a guided discussion on the importance of

Competence(s)	Content	Teaching/ Learning Strategies
		Kiswahili to a learner, parent, a business man and a leader of any category.

Assessment Strategy

Assign the learner to communicate the importance of Kiswahili to a technician and a business man.

Teaching/Learning Resource

The internet

Sub-module 2: Polite Language

Duration: 18 Hours

Competences	Content	Teaching/ Learning Strategies
The learner : • greets peers, parents and supervisors in Kiswahili. • names places and people in their capacities. • appreciates others by saying 'thank you' and 'well-done' in	• 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 • Asking for directions, assistance, food • Names of places, like schools, hospitals, markets, garages,	• Lead a guided discussion on the correct use of Kiswahili in greeting peers, elders and supervisors. • Lead a guided discussion on the use of 'thank you', 'welcome' and 'sorry' in Kiswahili. • Using

Competences	Content	Teaching/ Learning Strategies
Kiswahili.	roads, airports, water wells, forests, villages, towns, sites, hills • Names of people and professional titles like technicians, nurses, messengers, watchmen, drivers, doctors, teachers, students	illustrations, lead a guided discussions on giving directions such as move forward, north, left, east, south, west and right hand side in Kiswahili.

Assessment Strategy

Assign the learner to write the names of common food in our homes.

Teaching/Learning Resource

The internet

TCAM 201: Automotive Technology and Maintenance II

Duration: 50 Hours

Module Overview

The module equips learners with the skill of troubleshooting faults, repairing and maintaining vehicle systems in good working condition. The module also introduces the learner to combustion chamber designs and processes, fuel supply system, alternative engines, forced induction and engine management.

Learning Outcome

By the end of this module, the learner should be able to repair and maintain Super chargers of engines, describe the production of ferrous metals and troubleshoot faults, repair and maintain vehicle systems in good working condition.

Preparatory Assignment

Take learners to the workshop and demonstrate the procedure of handling petrol engine. Ask the learners to take sketches and discuss the challenges.

Result

Learners visit the workshop and observe the teacher's demonstration, take sketches, discuss and make a group presentation.

Sub- module 1: Combustion Process and Combustion Chamber Designs

Duration- 8 Hours

Competences	Content	Teaching/Learning Strategies
The learner • illustrates the combustion process and analyses the effect of combustion chamber designs on the combustion process in the combustion chamber of an engine. • ensure health, safety and security of combustion chamber and its components.	• Combustion process in petrol engine (S.I.) • Combustion process in diesel engine (C.I) and types of combustion chambers, advantages and disadvantages (terms applied) • Combustion chambers for S.I. and C.I. engines • Crankshaft assembly vibrations • Health, safety and security of, vehicle and environment when handling combustion chambers.	• Illustrate the combustion process and analyse the effect of combustion chamber designs on the combustion process in the combustion chamber of an engine. • Lead a guided discussion on the health, safety and security of combustion chamber and its components.

Assessment Strategy

Assign the learner to illustrate the combustion process and analyse the effect of combustion chamber designs on the combustion process in the combustion chamber of an engine.

Teaching / Learning Resources

- Old diesel and petrol engine
- Running petrol and diesel engines
- Cylinder heads
- Spanners
- Video CDs
- Computer
- Projector
- DVD player
- TV monitor

Sub- module 2: Fuel Supply System

Duration-10 hours

Competences	Content	Teaching/Learning Strategies
The learner: • describes the construction and operation of the fuel supply systems for the spark and compression ignition and maintains the main components to their normal function.	• Fuel injection system in S.I. engine (EFI) • Fuel injection system in C.I. engine (conventional/ ordinary) • Injector pump, injector nozzle tests and air bleeding diesel fuel system • Diesel Electronic fuel injection system • Health, safety and security of vehicle	• Lead a guided discussion on description of the construction and operation of the fuel supply systems for the spark. • Guide learners through practice on the procedure of maintaining the main components of fuel supply systems to their normal function. • Guide learners on the health, safety and security of

• ensures health, safety and security of vehicle and environment when handling fuel supply systems.	and environment when handling fuel supply systems.	vehicle and environment when handling fuel supply systems.

Assessment Strategies

Assign the learner to describe the construction and operation of the fuel supply systems for the spark and compression ignition and maintain the main components in their normal function.

Teaching / Learning Resources

- Running vehicles
- Common rail diesel engine
- Fuel
- Fuel pressure tester gauge
- Injection pump testing machine
- Injector nozzle over haul kit
- Injector nozzle tester
- Internet and its YouTube
- Tool kit/box
- Cleaning appliances/materials
- Multimeter
- Repair manual
- Video CDs/DVDs
- Over head projector
- Computer
- Inline injector pump
- The distributor
- Injection pump

Sub-module 3: Alternative Engines

Duration: 10 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • identifies alternative engines as sources of power and describes their construction and operation in relation to their maintenance. • ensures health, safety and security of vehicle and environment when handling alternative engines.	• Wankel engine • Gas-turbine engine • Health , safety and security of vehicle and environment when handling alternative engines	• Illustrate the identification of alternative engines as sources of power. • Lead a guided discussion on the description of alternative engines construction and operation in relation to the maintenance. • Guide learners on the health, safety and security of vehicle and environment when handling alternative engines.

Assessment Strategy

Assign the learner to identify alternative engines as sources of power and describe their construction and operation in relation to the maintenance.

Teaching / Learning Resources

- Writing board
- Repair manual
- charts

- Video CDs/DVDs
- Over head projector
- Computer

Sub-module 4: Super Charging and Turbo Charging Engines (Forced Induction)

Duration: 10 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • repairs and maintains super chargers of engines as methods of increasing engine power output. • ensures health, safety and security of vehicle and environment when handling turbo charging engines.	• Super charger • Turbo-charger • Inter-cooler and waste-gate • Health, safety and security of vehicle when handling super charger engines.	• Guide learners through practice on the procedure of repairing and maintaining Super chargers of engines as methods of increasing engine power output. • Guide learners on the health, safety and security of vehicle and environment when handling turbo charging engines.

Assessment Strategy

Assign the learner to repair and maintain super chargers of engines as methods of increasing engine power output.

Teaching/Learning Resources

- Chalk board/writing boards
- Turbo charger

- real objects
- Super charger
- Relevant textbooks/ notes
- Internet.
- Models

Sub-module 5: Modern Engine Management Systems

Duration: 12 Hours

Competences	Content	Teaching/Learning Strategie
The learner: • identifies the main components of modern engine management systems and maintains them to their normal function. • ensures health, safety and security of vehicle and environment when handling modern engine systems.	• Engine sensors systems • Engine Electronic Control Unit/Module (ECU or ECM) • Engine actuators • Engine diagnosis and troubleshooting • Health, safety and security of vehicle when handling modern engine systems.	• Guide learners through practice to identify the main components of modern engine management systems and maintain them to their normal function. • Demonstrate the procedure of maintaining modern engine systems to their normal function and task learners to practise. • Guide learners on the health, safety and security of vehicle and environment when handling modern engine systems.

Assessment Strategies

Assign the learner to identify the main components of modern engine management systems and maintain them to their normal function.

Teaching/Learning Resources

- Chalk board/writing boards
- real objects
- EFI engine
- Relevant textbooks/ notes
- Internet.
- Model
- A multi meter
- OBD tester
- Chapman, J. K. (1983). *Workshop Technology*. 4th Edition; Macmillan Press Ltd.
- Gupta, G. K.(1985). *Workshop Technology*. 3rd Edition; Macmillan Press Ltd.
- Hillier, V.A.W(1986). *Fundamentals of Motor Vehicle Technology*. 5th Edition; Macmillan press Ltd.
- Mudd, S.C. (1986). *Technology for Motor Mechanics*. 2nd Edition; Edward Arnold (Publishers) Ltd.
- Pritchard, R. T. (1979). *Technician Workshop Processes and Materials.* 3rd Edition; Hodder and Stoughton Ltd.
- Stockel, M. W. and Stockel, M. T.(1984). *Auto service and Repair.* 4th Edition; Good Heart, Willicox Company, Inc

TCAM 202: Automotive Electric and Electronics Practice II

Duration: 40 Hours

Module Overview

The module equips learners with the skill of troubleshooting electrical faults, repairing and maintaining the electronic systems of the vehicle.

Learning Outcome

By the end of this module, the learner should be able to describe the construction and operation of engine management systems, describe the construction and operation of instrumentation system and troubleshoot electrical faults, repair and maintain the electronic systems of the vehicle and ensure health, safety and security of the vehicle and its environment.

Preparatory Assignment

Learners are given different circuit diagrams to demonstrate practical exercises.

Result

Learners do practical exercises.

Sub-module1: Engine Management

Duration: 10 Hours

Competences	Content	Teaching/Learning Strategies
The learner : • describes the construction and operation of: - electronic	• Electronic ignition system • Distributor	• Lead a guided discussion on the construction and operation of

Competences	Content	Teaching/Learning Strategies
ignition system. - distributor and direct ignition system. - electronic fuel control systems. - Turbocharger electronic control. - emission control system. - maintains the main components of engine management system to their normal function. • ensures health, safety and security of vehicle and environment when managing the engine.	and direct ignition system • Electronic fuel control systems • Turbocharger electronic control • Emission control system • Health, safety and security of vehicle and environment when managing the engine.	engine management systems for the spark and compression ignition. • Guide learners through practice on how to maintain the main components of engine management to their normal function. • Guide learners on the health, safety and security of vehicle and environment when managing the engine.

Assessment Strategy

Assign the learner to describe the construction and operation of engine management systems for the spark and compression ignition and maintain the main components to their normal function.

Teaching/Learning Resources

- Chalk board/writing boards
- Power point

- Real objects
- Slides and display charts
- Internet.
- Petrol EFI engine
- Running diesel EFI engine
- Ignition distributors
- Multimeter
- Exhaust hose reel
- Inductive hall – type power point
- Engine tune-tester
- Stroboscope
- Engine exhaust gas analyser
- Toolbox

Sub –module 2: Engine Diagnosis

Duration: 16 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • troubleshoots engine faults using diagnostic gauges and equipment. • ensures health, safety and security of vehicle and environment when handling engine diagnosis.	• Electronic ignition system • Distributor and direct ignition system • Electronic fuel control systems • Turbocharger electronic control • Emission control system • Health, safety and security of vehicle during engine diagnosis.	• Lead learners through practice to troubleshoot engine faults using diagnostic gauges and equipment. • Guide learners on how to ensure the health, safety and security of vehicle and environment when handling engine diagnosis.

Assessment Strategy

Assign the learner to troubleshoot engine faults using diagnostic gauges and equipment.

Teaching/Learning Resources

- Chalkboard/writing boards
- PowerPoint
- Real objects
- Slides and display charts
- Internet
- Petrol EFI engine
- Running diesel EFI engine
- Ignition distributors
- Multimeter
- Exhaust hose reel
- Inductive hall–type PowerPoint
- Engine tune-tester
- Stroboscope
- Engine exhaust gas analyser
- Toolbox

Sub-module 3: Generator Electronic System

Duration: 6 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • identifies the main components of modern generator electronic system and maintains	• Generation , rectification and filtering • Electronic regulators • High power LED light	• Lead learners through practice to identify the main components of modern generator electronic system and maintain them to their normal

Competences	Content	Teaching/Learning Strategies
them to their normal function. • ensures health, safety and security of vehicle and environment when handling generator electronic system.	source • Health, safety and security of environmen t and the generator electronic system	function. • Lead a guided discussion on the health, safety and security of vehicle and environment when handling generator electronic system.

Assessment Strategy

Assign the learner to identify the main components of modern generator electronic systems and maintain them to their normal function.

Teaching/Learning Resources

- Chalk board/writing boards
- PowerPoint
- Real objects
- Slides and display charts
- *Fundamentals of Motor Vehicle Technology (Power Train Electronics)*by Hillier, 5th Edition
- Internet
- Documentaries of recent motor vehicle technology
- Recent models car

Sub-module 4: Vehicle Lighting /Signalling

Duration: 4 Hours

Competences	Content	Teaching / Learning Strategies
The learner: • illustrates lighting /signal circuit and its related repairs. • demonstrates the procedures of repairing lighting/signal circuit. • ensures health, safety and security of the environment and vehicle lighting system.	• Lights • Mirrors • Vehicle wind Screens • Signalling • Health, safety and security of vehicle lighting system	• Illustrate lighting /signal circuit and its related repairs and let learners emulate. • Guide learners through practice on the procedures of repairing lighting /signal circuit. • Lead a guided discussion on the health, safety and security of the environment and vehicle lighting system

Assessment Strategies

Assign the learner to:

- identify and draw different types of lighting systems and circuit diagrams.
- trace faults in various lighting circuits.
- identify the different types of driving mirrors.
- describe operation of manually and electrically controlled mirrors.
- remove and install wind screens.

Teaching/Learning Resources

- Chalk board/writing boards

- PowerPoint
- Real objects
- Slides and display charts
- *Fundamentals of Motor Vehicle Technology (Power Train Electronics)* by Hillier, 5th Edition.
- Internet
- Documentaries of recent motor vehicle technology
- Recent models car
- Different types of wind screens
- Tool box

Sub-module 5: Vehicle Instrumentation System

Duration: 4 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • describes the construction and operation of instrumentation system for the vehicle and maintains the main components to their normal function. • ensures health, safety and security of vehicle and environment when carrying	• Types of vehicle instrumentation and displays • Operation and application of the different types of vehicle instrumentation and displays • Circuits for vehicle instrumentation and displays • Faults for vehicle instrumentation and displays • Types of driver	• Lead a guided discussion on description of the construction and operation of instrumentation system for the vehicle and maintenance of the main components to their normal function. • Guide learners through practice on the procedure of maintaining the main components of a vehicle

Competences	Content	Teaching/Learning Strategies
out repair of instrumentation system.	entertainment and communication systems • Operation of the various types of driver entertainment and communication systems • Health, safety and security of vehicle instrumentation system	instrumentation system to their normal function. • Lead a guided discussion on the health, safety and security of vehicle and environment when carrying out repair of instrumentation system.

Assessment Strategies

Assign the learner to:

- identify different types of vehicle instrumentation and displays.
- describe operation and application of the different types of vehicle instrumentation and displays.
- draw circuits and identify faults for vehicle instrumentation and displays.
- observe safety precautions when handling electronic system.

Teaching /Learning Resources

- Chalk board/writing boards
- PowerPoint
- Real objects
- Slides and display charts
- Internet
- Documentaries of recent motor vehicle technology
- Recent models of cars

- Tool box
- Dashboard assembly
- Hillier, V.A.W. (1986). *Fundamentals of Motor Vehicle Technology*. 5th Edition; Macmillan Press Ltd.
- Mudd, S.C. (1986). *Technology for Motor Mechanics*. 2nd Edition; Edward Arnold (publishers) Ltd.
- Stockel, M.W. and Stockel, M. T. (1984). *Auto Service and Repair*. 4th Edition; Good Heart, Willicox Company, Inc.

TCAM 203: Technician Science II

Duration: 30 Hours

Module Overview

The module equips learners with the skill of analysing the effect of frictional force in transmission systems of a vehicle. The module introduces the learner to aspects related to friction, transmission of motion and power in motor vehicles.

Learning Outcomes

By the end of this module, the learner should be able to describe the production of ferrous metals from the ore and select some for use according to their properties, enhance the properties of carbon steel using heat treatment, describe the production of non-ferrous metals from the ore and analyse the effect of frictional force in transmission systems of a vehicle.

Preparatory Assignment

Prior to teaching this module task learners to describe the various types of friction.

Result

Learners describe the various types of friction.

Sub- module 1: Engineering Materials

Duration- 6 Hours

Competences	Content	Teaching/Learnir Strategies
The learner describes the production of ferrous metals from	• The metallic ore • Blast furnace • Cast iron • Wrought iron (manufacture)	• Lead a guided discussion on description of the

Competences	Content	Teaching/Learni Strategies
the ore and selects some for use according their properties.	• Manufacture mild steel • Bessemer converter processes • Open health furnace • Electric Arc furnace • Crucible steel furnace • Properties of metals • Properties of iron alloys • Plain carbon steel • Alloy steel • Alloy elements	production of ferrous metals from the ore. • Illustrate using sketches the selection of ferrous metals using their properties and ask learners to practise.

Assessment Strategy

Assign the learner to describe the production of ferrous metals from the ore and select it for use according their properties.

Teaching / Learning Resources

- Writing board
- Repair manual
- materials
- Work bench
- Charts
- TV monitor

Sub-module 2: Heat Treatment

Duration: 4 Hours

Competences	Content	Teaching/Learning Strategies
The learner changes the properties of carbon steel using heat treatment to meet engineering application.	• Heat treatment of carbon steel • Methods of heating	Demonstrate how to change the properties of carbon steel using heat treatment to meet engineering application and allow learners to practise.

Assessment Strategy

Assign the learner to change the properties of carbon steel using heat treatment to meet engineering application.

Teaching/Learning Resources

- Writing board
- Repair manual
- Materials
- Work bench
- Charts
- TV monitor

Sub- module 3: Nonferrous Metals

Duration: 4 Hours

Competences	Content	Teaching/Learning Strategies
The learner describes the production of non-ferrous metals from the ore and selects some for use according to	• Aluminium • Copper • Tin • Zinc • Lead • Brass, bronze,	• Lead a guided discussion on description of the production of non-ferrous metals from the ore. • Illustrate using sketches the selection of non-

Competences	Content	Teaching/Learning Strategies
their properties.	tinning lead alloy	ferrous metals using their properties and ask learners to emulate.

Assessment Strategy

Assign the learner to describe the production of non-ferrous metals from the ore and select some for use according to their properties.

Teaching / Learning Resources

- Writing board
- Repair manual
- Materials
- Work bench
- Charts
- TV monitor

Sub-module 4: Friction

Duration 10 Hours

Competences	Content	Teaching/Learning Strategies
The learner describes the various types of friction and determines the frictional torque of the bearings, Plate clutches, brakes.	• Types of friction • Effects of friction • Co-efficient of friction • Angle of friction incline and horizontal planes • Friction bearings • Plate clutches • Brakes • Frictional torque • Power loss and heat generated	• Lead a guided discussion on description of the various types of friction. • Illustrate how to determine the frictional torque of the bearings, plate clutches, brakes.

Assessment Strategy

Assign the learner to describe the various types of friction and determine the frictional torque of the bearings, Plate clutches, Brakes

Teaching/Learning Resources

- Chalkboard/ writing boards
- Power point
- Slides and display charts
- Sc and calculations by champion 1 and 2
- Internet
- Library
- Model engine
- Workshop/ laboratory

Sub-module 5: Transmission of Motion and Power

Duration: 6 Hours

Competences	Content	Teaching/Learni Strategies
The learner determines the power required in the transmission systems.	• Transmission of power by belt, chain and gear wheel • Velocity and gear ratio • Efficiency of drive • Steering gear box	Illustrate to learners how to determine the power required in the transmission systems.

Assessment Strategy

Assign the learner to determine the power required in the transmission systems.

Teaching/Learning Resources

- Chalkboard/ writing boards
- Power point
- Slides and display charts
- Slides and over head projector
- Relevant text books/notes
- Internet
- Library
- Model engine
- Workshop/ laboratory
- Science and calculations by champion 1 and 2
- Edward, A. (1986). *Principles of Engineering Mechanics*. 2nd Edition; UK, Longman Group UK Ltd.
- Hannah. J. and Hillier, M. J., (1984). *Applied Mechanics*. 4th Edition; PITMAN Publisher Ltd.
- Zammit S.J. (1987). *Motor Vehicle Engineering Science for Technicians.* 2ndEdition; UK, Longman Group UK Ltd.

TCAM 204: Technical Drawing II

Duration: 30 Hours

Module Overview

The module equips learners with the skill of interpreting and drawing various engineering parts which is used as communication medium for production of engineering parts.

Learning Outcome

By the end of this module the learner should be able to interpret correctly, draw correctly various engineering parts which are used as communication media for production of engineering parts.

Preparatory Assignment

Give the learners different components with various types of screw threads and locking devices and ask them to draw.

Result

Learners draw screw threads and locking devices and submit for marking.

Sub- module 1: Screw Threads

Duration 10 Hours

Competences	Content	Teaching/Learning Strate
The learner describes various types of screw thread forms and constructs the square screw threads.	• Thread terms • Thread forms • Application of screw threads • The ISO metric thread • Square screw construction • Other thread forms	• Lead a guided discussion on describing various types of screw thread forms. • Guide learners through practice on how to construct the square screw threads.

Assessment Strategies

Assign the learner to describe various types of screw thread forms and construct the square screw threads.

Teaching / Learning Resources

- Chalk board/writing boards
- Computers
- Bolts and nuts
- Workshop
- Machines visit
- Screw fasteners
- Drawing instruments/equipment
- Projectors
- Slides and display charts
- Internet

Sub-module 2: Fasteners and Locks

Duration: 20 Hours

Competence	Contents	Teaching/Learnir Strategies
The learner draws the various types of fasteners and locks.	• Temporary fastener • Permanent fastener • Locking devices (locking nuts, locking washers, locking pins/ cotter pins/spilt pins, locking wires, locking keys and key ways)	Demonstrate how to draw the various types of fasteners and locks and let learners practise.

Assessment Strategy

Assign the learner to draw the various types of fasteners and locks.

Teaching /Learning Resources

- Chalk board/writing boards
- Nuts
- Washers

- Lock pins
- Locking wires
- Woodruff keys
- Key-shafts
- Drive pulleys
- Drive gears
- Drive sprockets
- Computers
- Sample models
- Drawing instruments/equipment
- Projectors
- Slides and display charts
- Internet
- Pick Up and Parker, (1987). *Engineering Drawing with Worked Examples.* 2nd Edition; UK, Longman Group Ltd.
- Torrice (1986).*Technical Drawing for Today*. 2nd Edition; UK, Longman Group Ltd.

TCAM 205: Real Life Project II

Duration: 40 Hours

Module Overview

This project equips the learners with practical skills in analysing design requirements, selecting materials, assembling functioning systems, selecting troubleshooting methods, dismantling and assembling machine parts to their proper functioning.

Learning Outcome

By the end of this module, the learner should be able to analyse designs, select materials, assemble functioning systems, select troubleshooting methods, dismantle and assemble machine parts to their proper functioning.

Preparatory Assignment

Before teaching this module, task learners with expert assignment at the initiation, planning, execution, control and closure stage of real life project.

Result

Learners do the expert assignment at every stage of real life project.

Competences	Content	Teaching/Learning Strategies
The learner: • prepares and interprets engineering drawings. • identifies materials and tools. • innovates and	• Projects • Repair and service of Starter motor • Repair and service of ECU and fuel system • Repair and service of lighting system or alarm • Repair and service of	• Demonstrate to the learners the stages of producing the selected project beginning with simple expert example.

Competences	Content	Teaching/Learning Strategies
modifies components. • selects the troubleshooting methods to identify the faults. • interprets the operation manuals. • identifies materials and consumables. • selects the tools and components. • dismantles and assembles machine parts. • sustains constant maintenance of the unit. • assembles components. • tests and operates the transmission system. • costs and quantifies materials. • tests the machine. • prepares	the ignition switch • Repair and service of fuel gauges, air flow meter • Repair and service of generators • Repair of stripped spark plug threads • Repair and service of manual gear box • Repair and service of Drive lines • Repair and service of a differential unit • Repair and service of an automatic gear box • Repair and service of electronic control body system • Repair and service of vehicle air conditioning , heating and ventilation system • Repair and service of pneumatic (air) braking system • Repair and service of antilock braking system • Repair and service of Traction Control System (TCS) brakes • Repair and service of power assisted steering system • Repair and service of	• Guide learners how to prepare project reports. • Lead a guided discussion on the Health, safety and security of vehicle and environment when carrying out project activities.

Competences	Content	Teaching/Learning Strategies
project reports. • ensures health, safety and security of vehicle and environment when carrying out project activities.	twin and four wheel steering • Repair and service of suspension system • Wiring of a vehicle and motor cycle fabrication of mechanical jack fabricate vehicle guard bracket panel bit section of bent car *NOTE: The project(s) should be completed by the end of second year.*	

Assessment Strategy

Assign the learner to fabricate a simple component or maintenance of engines to good working condition.

Teaching/Learning Resources

- Writing board
- Instruments and equipment
- Safety standards
- Project materials
- tools
- Charts
- Models
- PowerPoint
- Internet
- Chapman, J. K. (1983).*Workshop Technology*. 4th Edition; Macmillan Press Ltd.

- Gupta, G. K. (1985). *Workshop Technology*. 3rd Edition; Macmillan Press Ltd.
- Hillier, V.A.W. (1986). *Fundamentals of Motor Vehicle Technology.* 5th Edition; Macmillan press Ltd.
- Mudd, S.C. (1986). *Technology for Motor Mechanics*. 2nd Edition; Edward Arnold (publishers) Ltd.
- Pritchard, R. T. (1979). *Technician Workshop Processes and Materials.* 3rd Edition; Hodder and Stoughton Ltd.
- Stockel, M. W. and Stockel, M. T. (1984). *Auto service and Repair.* 4th Edition; Good Heart Willicox Company, Inc
- Pick Up and Parker, (1987). *Engineering Drawing with Worked Examples*. 2nd Edition; UK, Longman Group Ltd.

Description of Year 2 Term 1I

Code	Module Title	Total Hours	Hours Per Week
TCTM 201	Applied Technician Mathematics I	40	4
TCBE 201	Entrepreneurship Skills	30	3
TCCS 201	Basic Kiswahili	20	2
TCAM 201	Automotive Technology and Maintenance II	50	5
TCAM 202	Automotive Electric and Electroni Practice II	40	4
TCAM 203	Technician Science II	30	3
TCAM 204	Technical Drawing II	40	4
TCAM 205	Real life Project II	40	4
Total		**290**	**29**

TCTM 201: Applied Technician Mathematics II

Duration: 40 Hours

Module Overview

This module helps learners in analysing structures, and to design and develop structures and methods of utilising materials and forces of nature for the benefit of humanity.

Learning Outcome

By the end of this module, the learner should be able to apply calculus in determining the bending moments of beams.

Preparatory Assignment

Take learners to nearby identified sagging beams and task them to discuss the causes, and ways of limiting beams from failures like sagging. In groups, task them to write a report and make presentations in the class.

Result

Learners visit the identified sagging beams, discuss the causes, write a report and present in class.

Sub-module 4: Differentiation

Duration 14 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • differentiates the variables from first principle. • differentiates the product and quotient. • applies differential equations in determining beam deflections.	• Differentiation from first principle • Differentiation of product and quotient • Choice of variable	• Lead a guided discussion on engineering application of differentiation. • Guide learners on the manipulation of differentiation from the first principle. • Illustrate using examples the methods of differentiating the product and the quotient and task learners to practise. • Guide learners through the approaches used on choice of variables.

Assessment Strategy

Assign the learner to determine structural beam deflections.

Teaching/Learning Resource

Scientific calculator

Sub-module 5: Integration; Single and Double Integrals

Duration: 16 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • 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.	• Integration' the reverse of Differentiation • Standard Integrals • Functions of Linear function of 'x' • Integration of Polynomial functions • Integration by partial fractions • Areas under curves	• Lead a guided discussion on engineering application of integrations. • Illustrate the manipulation of linear functions of 'x' to determine the gradient. • Guide learners in the integration of polynomial functions to determine the size and area of a simple structure. • Together with learners manipulate partial fractions to get a common denominator. • Clarify on integration principle and guide learners to calculate the area of a structure.

Assessment Strategy

Assign the learner to:

- determine the gradient by application of linear function of 'x'.
- integrate by partial fractions.

Teaching/Learning Resource

Scientific calculator

Sub-module 6: Elementary Functions

Duration: 10 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • manipulates functions in rules.	• Functions in rules	• Illustrate the manipulation of functions in rules and guide learners to practise.
• applies inverse of a function.	• Functions and the arithmetic functions	• Demonstrate the application of inverse of functions and guide learners to practise.
• draws graphs.	• Inverse of a function and graphs	• Guide learners through illustrations on the procedure followed in drawing graphs of functions.

Assessment Strategy

Assign the learner to draw graphs of functions.

Teaching/Learning Resources

- Scientific calculator
- Mathematical set
- Hard board
- Graph papers
- Log table
- Stroud K.A., (2002). *Engineering Mathematics*. 4th Edition. Macmillan

- Hancock, D. J. (1982). *Mathematics for Technicians Level 1*. Granada. Technical Series
- Hancock D. J. (1982). *Mathematics for Technicians Level 2.* Granada. Technical Series
- Hancock D. J. (1982). *Mathematics for Technicians Level 3.* Granada. Technical Series

TCBE 201: Entrepreneurship Skills

Duration: 30 Hours

Module Overview

This term's content is intended to equip learners with knowledge, competences, and skills to successfully engage in production and manage a small business. The learner will be trained on how to produce quality goods/services for sale, market the products, 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/services.
- market the products.
- enhance competitiveness of the product through market survey.
- manage business finances.
- guide and control the business workforce.

Preparatory Assignment

Task learners to collect and compile information on products of their choice to be produced, and show the transformation process into a final product and how it will be packaged

Result

Learners get an insight/clue of the production process of different products and the need for packaging.

Sub-module 6: Production

Duration: 6 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • determines the cost of	• Production costing	• With the use of a sample cost sheet, guide learners on the

Competences	Content	Teaching/ Learning Strategies
production. • designs appropriate packaging for the product. • adds value to the product.	• Packaging (Protection , Handling, Preservation and presentation of a product) • Value addition	elements of costing and task them to complete filling a cost sheet. • Display various sample packaging materials, task learners to identify the features of suitable packaging material for different products. • Guide learners in a discussion on quality improvement. • Show a documentary on how a product is produced, packaged and preserved with reference to value addition and task learners to critique. • Take learners for an industrial tour to study the value addition processes and task them to write reports on their observations and make presentations.

Assessment Strategy

Assign the learner to:

- compute the cost of producing a product and show the net profit or income.
- assess the qualities of packaging material and show the importance of packaging.

Teaching/Learning Resources

- Television set, computer, and a cell phone
- Calculators
- Cost sheet sample

- Source documents (Cash receipts, pro-forma invoice, local purchase order)
- Sample packaging material and labels
- Business journals
- Internet
- Documentaries

Sub-module 7: Marketing

Duration: 6 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • carries out a market survey. • applies the 4Ps in marketing a product. • promotes the product for sale.	• Market survey • Marketing mix (Price, Place, People, Product 4Ps) • Sales promotio n	• Guide learners to discuss the importance of market survey in business and selection of a survey tool. • Group learners and task them to carry out a market survey in their localities for certain products and make reports of their findings. • Guide learners in a discussion on applying the 4Ps in marketing a product. • Invite a sales promoter to enlighten learners on sales promotion strategies and encourage them to ask questions. • Guide learners to role-play how sales promotion is done.

Assessment Strategies

Assign the learner to:

- discuss the importance of the 4Ps in marketing a product.

- practise a sales promotion bazaar in the institution.

Teaching/Learning Resources

- Sample market survey tool
- Newspapers
- Business journals
- Calculators
- Internet
- Documentaries
- Computer and projector
- Sales promoters

Sub-module 8: Financial Management

Duration: 12 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • maintains basic business records. • computes business profits/losses. • prepares simple income statements, balance sheet and cash flow statements.	• Bookkeeping (Recording transactions, source documents, Journals, Balancing accounts, Trial balance, Bank reconciliation) • Simple income statement, balance sheet and cash flow statements	• Guide a discussion on the importance of bookkeeping. • Illustrate the preparation of the basic source documents and books of accounts and task learners to practise. • Lead learners to an accounting office to get exposed to functional bookkeeping practices and task them to relate what they have observed with what they learnt. • Illustrate the preparation of a simple Income statement, balance sheet and cash flow statement and guide learners to practise.

Assessment Strategies

Assign the learner to:

- prepare books of accounts for a small business (ledgers, journals).
- prepare a simple income statement, Balance sheet, cash flow statement for a small business.

Teaching/Learning Resources

- Calculators
- Samples of source documents
- Samples of books of accounts
- Internet
- Documentaries
- Projector
- Television set, computer, a cellular phone

Sub-module 9: Human Resource Management

Duration: 6 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • orients the business employees. • maintains a motivated workforce. • appraises staff. • incorporates a compensation policy for the employees. • shares	• Orientation • Importance of motivation • Performance Appraisal • Compensation in compliance with labour laws • Need for delegation and	• Guide learners in a discussion on how to adapt employees to the business ideologies, values and procedures of doing work. • Task learners to brainstorm on the ways of motivating workers and the development of motivational packages in a small business. • Using sample performance appraisals documents, guide

Competences	Content	Teaching/Learning Strategies
responsibilities with employees. • recognises the contribution of workmates. • identifies causes of conflicts in small enterprises. • resolves conflicts at the work place.	challenges encountered • Importance of team work • Settling conflicts at workplace	learners to demonstrate the performance appraisal process. • Guide learners in a discussion on the importance of labour compensation laws. • Task learners through a discussion on instances when delegation is necessary in a business and identify the challenges associated. • Assign learners to identify the contributions of other members in their real life projects and make presentations on how teamwork helps in achieving success. • Lead learners to discussion on the ways of resolving conflicts in small enterprises.

Assessment Strategies

Assign the learner to:

- design orientation plan for new employees.
- develop motivation strategies.
- develop a performance appraisal tool.
- discuss the different ways of mitigating conflicts in a small enterprise.

Teaching/Learning Resources

- Television set, computer and a cellular phone
- Labour laws
- Newspapers
- Industrial Court cases
- Internet
- Documentaries on Workers' Union activities
- Sample performance appraisal forms

TCCS 201: Basic Kiswahili

Duration: 20 Hours

Module Overview

This module introduces the learners to the basic Kiswahili used in the industries and by 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.

Preparatory Assignment

Give learners an assignment to translate numbers 1-10 in Kiswahili in groups.

Result

Learners write the translation of the numbers and present in the class.

Sub-module 3: Comprehension

Duration: 10 Hours

Competences	Content	Teaching/ Learning Strategies
The learner : • counts numbers 0-1000000 in Kiswahili. • identifies and names the parts of the human body in Kiswahili.	• 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	• Illustrate the vowels used in Kiswahili and lead a guided discussion on their application. • Use illustrations to lead a guided discussion on the application of the consonants used in Kiswahili. • Guide learners to count numbers in Kiswahili 0-1000000. • Lead a guided discussion on the daily and common activities and word meanings in Kiswahili.

Assessment Strategy

Assign the learner to write numbers in Kiswahili.

Teaching/Learning Resources

The internet
Kiswahili dictionary

Sub-module 4: General Vocabulary

Duration: 10 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • names domestic animals, birds and insects in Kiswahili. • mentions the days of the week, names the months of the year and tells the correct dates.	• 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 • Month 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.	• Guide learners to discuss the names of domestic animals, birds and insects in the environment. • With the help of the calendar guide learners to name the days of the week, months of the year and the dates of the months. • Lead a guided discussion on the common mistakes to be avoided in Kiswahili. • Guide learners to identify and name the objects and activities in the environment.

Assessment Strategy

Assign the learner to name objects in the environment.

Teaching/Learning Resources

- The internet
- References
- Maw, J. E. (1999). *Swahili for Starters. A Practical Introductory and Intermediate Level.*
- Almasi, W. F. (2014). *Swahili Grammar for Introductory and Intermediate Levels.*
- Biersteker, Ann. (1990). *Masomo Ya Kisasa. Contemporary Reading in Kiswahili.*

TCAM 201: Automotive Technology and Maintenance II

Duration: 50 Hours

Module Overview

This module introduces the learner to skills of troubleshooting faults, repairing and maintenance of automatic transmission system of a vehicle.

Learning Outcome

By the end of this module, the learner should be able to operate machine tools to produce parts, install and restore final drive transmission system, locate the main components of steering system and maintain them to their normal function and troubleshoot faults, repair and maintain automatic transmission system of a vehicle and ensure the health, safety and security of the equipment when operating machine tools.

Preparatory Assignment

Prior to teaching this module task learners to make neat sketches of epicyclic gear trains.

Result

Learners make neat sketches of epicyclic gear trains

Sub-module 6: Machine Tools

Duration: 10 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • operates machine tools to	• Introduction to lathe machines • Drilling machine	• Demonstrate the techniques of operating

Competences	Content	Teaching/Learning Strategies
produce parts. • applies the health , safety and security of the equipment when operating machine tools.	• Grinding machine • Milling machine • Shaping machine • Power saw machine • Re-surfacing machine • Safety, health and security of equipment	machine tools to produce parts. • Demonstrate to the learners the health, safety and security of the equipment when operating machine tools.

Assessment Strategy

Assign the learner to operate machine tools to produce parts

Teaching / Learning Resources

- Chalk board/writing boards
- Power point
- Machine tools
- Work pieces
- Real objects
- Slides and display charts
- Internet
- Models

Sub-module 7: Automatic Transmission System

Duration : 14 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • identifies and locates the main components of the automatic transmission system and maintains them to their normal function. • ensures safety, health and security of environment and automatic transmission system.	• Epicyclic gear train • Principle of fluid coupling • Fluid flywheel • Hydraulic torque converter • Brake bands and clutches • Safety, health and security of automatic transmission system.	• Lead learners through practice to identify and locate the main components of the automatic transmission system. • Demonstrate the techniques of maintaining the main components of the automatic transmission system. • Guide learners on the safety, health and security of the environment and automatic transmission system.

Assessment Strategy

Assign the learner to identify and locate the main components of the automatic transmission system and maintain them to their normal function.

Teaching/Learning Resources

- Chalk board/writing boards
- Real objects
- Slides and display charts
- Internet

- Models
- Automatic engine and gearbox.
- Working models
- Projector

Sub-module 8: Final Drive Transmission System

Duration: 12 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • installs and restores final drive transmission system. • ensures safety, health and security of the environment and automatic transmission system.	• Differential locking system • Limited slip differential unit • Single speed double reduction • Two speed double reduction • Multi axle drive • Health, safety and security of the environment and automatic transmission system.	• Demonstrate the installation and restoration of final drive transmission system. • Guide learners on how to ensure the safety, health and security of the environment during installation of final drive transmission system.

Assessment Strategy

Assign the learner to install and restore final drive transmission system.

Teaching / Learning Resources

- Chalkboard

- Charts
- Models
- PowerPoint presentations
- Site/Industrial visits
- Internet
- Running vehicle

Sub-module 9: Steering System

Duration: 14 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • locates the main components of steering system and maintains them to their normal function. • ensure safety, health and security of the environment during repair of the steering system.	• Ackerman's geometry • Steering linkages • Steering boxes • Steering wheel alignment • Toe in / toe out • Castor and camber • Swivel and king pin inclination • Ball joints and truck rod ends • Safety, health and security of the steering system.	• Lead learners through practice to locate the main components of steering system and maintain them to their normal function. • Guide learners on how to ensure the safety, health and security of the environment during repair of the steering system.

Assessment Strategy

Assign the learner to locate the main components of steering system and maintain them to their normal function.

Teaching/Learning Resources

- Chalkboard
- Charts
- Models
- Power point presentations
- Site/Industrial visits
- Internet
- Running vehicle
- Chapman, J. K. (1983). *Workshop Technology*. 4th Edition; Macmillan Press Ltd.
- Gupta, G. K.(1985). *Workshop Technology*. 3rd Edition; Macmillan Press Ltd.
- Hillier, V.A.W. (1986). *Fundamentals of Motor Vehicle Technology*. 5th Edition; Macmillan Press Ltd.
- Mudd, S.C. (1986). *Technology for Motor Mechanics*. 2nd Edition; Edward Arnold (publishers) Ltd.
- Pritchard, R. T. (1979). *Technician Workshop Processes and Materials.* 3rd Edition; Hodder and Stoughton Ltd.
- Stockel, M. W. and Stockel, M. T.(1984). *Auto service and Repair*. 4th Edition; Good Heart Willicox Company, Inc

TCAM 202: Automotive Electric and Electronics Practice II

Duration: 40 Hours

Module Overview

The module enables the learners to acquire the skill of troubleshooting electrical faults, repairing and maintaining the automatic transmission electronics control, body electrical, safety, and driver comfort systems.

Learning Outcome

By the end of this module, the learner should be able to locate the circuits of transmission electronics control, troubleshoot the faults in driver's safety control, repair and maintains them.

Preparatory Assignment

Before teaching this module, take learners to a workshop and task them to operate the safety button for gear lever movement.

Result

Learners operate the safety button for gear lever movement.

Sub-module 6: Transmission Electronics Control

Duration: 12 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • locates the circuits of transmission electronics control and	• Automated manual gear box (semi-automatic) • Automatic transmission	• Guide learners through practice to locate the circuits of transmission

Competences	Content	Teaching/Learning Strategies
maintains it for normal operation. • ensures safety, health and security of the environment during repair of the transmission electronics control.	(ECT) • Cruise control • Final drive and four wheel drive • Final drive and four wheel drive • Safety, health and security of the transmission electronics control.	electronics control and maintains it for normal operation. • Guide learners on how to ensure the safety, health and security of the environment during repair of the transmission electronics control.

Assessment Strategy

Assign the learner to locate the circuits of transmission electronics control and maintain it for normal operation.

Teaching / Learning Resources

- Gear box model of automated manual gear box (semi-automatic)
- A complete vehicle with automatic manual gear box (semi-automatic
- Tool box
- Special Service Tools (SST)
- Charts
- *Fundamentals of Motor Vehicle Technology* by hillier
- Modern automotive technology
- Complete vehicle with automatic transmission (ECT) type
- Model of Automatic transmission (ECT)
- EUROPA reference books
- A complete vehicle with cruise control system
- Auto data handbook
- On Board Diagnosis OBDII

Sub-module7: Driver's Comfort and Safety Control

Duration: 06 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • troubleshoots the faults in driver's safety control and restores its function. • ensure safety, health and security of the environment during repair of the drivers` comfort and safety control.	• Vehicle closure and security • Parking assistance • Power seat • Safety, health and security of drivers` comfort and safety.	• Demonstrate how to troubleshoot the faults in driver's safety control and restore its function. • Guide learners on the Safety, health and security of the environment during repair of the drivers` comfort and safety control.

Assessment Strategies

Assign the learner to troubleshoot the faults in driver's safety control and restore its function.

Teaching/Learning Resources

- OBD 11
- Modern automotive technology By Hillier
- Charts
- Simplified
- Circuits
- OHP
- Transparencies

- Simplified circuits
- OHP
- Transparencies
- Vehicle with power seats
- *Modern Automotive Technology* by Hillier
- Charts
- Simplified Circuits
- OHP
- Transparencies
- Vehicle with navigation system
- Vehicle with conditioner monitor
- Hillier, V. A.W. (1986). *Fundamentals of Motor Vehicle Technology*. 5th Edition; Macmillan Press Ltd.
- Mudd, S. C. (1986). *Technology for Motor Mechanics*. 2nd Edition; Edward Arnold (publishers) Ltd.
- Stockel, M.W. and Stockel, M. T., (1984). *Auto Service and Repair*. 4th Edition; Good Heart Willicox Company,Inc.

TCAM 203: Technician Science II

Duration: 30 Hours

Module Overview

The module equips learners with the skill of analysing the effects of motion of a vehicle and engine testing results. The module introduces the learner to vehicle motion and engine performance testing.

Learning Outcomes

By the end of this module, the learner should be able to calculate variables of linear motion of a vehicle, determine the parameters of engine performance and analyse the effects of motion of a vehicle and engine testing results.

Preparatory Assignment

Before teaching this module, task learners to describe the parameters.

Result

Learners describe the parameters.

Sub-module 6: Motion

Duration: 10 Hours

Competences	Content	Teaching/Learning Strategies
The learner calculates variables of linear motion of vehicles.	• Linear • Angular • Relative • Momentum	Illustrate how to calculate variables of linear motion of vehicles.

Assessment Strategy

Assign the learner to calculate variables of linear motion of vehicles.

Teaching/Learning Resources

- Chalkboard/ writing boards
- Power point
- calculator
- Slides and display charts
- Slides and overhead projector

Sub-module7: Engine Testing

Duration- 20 Hours

Competences	Content	Teaching/Learning Strategies
The learner determines the parameters of engine performance.	• Engine dynamometer • Exhaust gas analysis • Compression test • Brake power and engine torque test • Indicated power test • The Morse test • Fuel consumption test	Illustrate how to determine the parameters of engine performance.

Assessment Strategy

Assign the learner to determine the parameters of engine performance.

Teaching / Learning Resources

- Chalkboard/ writing boards
- Slides and display charts
- Engine test bed
- Model engine
- Workshop/ laboratory
- Running engine

- Edward, A. (1986). *Principles of Engineering Mechanics*. 2nd Edition; UK, Longman Group UK Ltd.
- Hannah, J. and Hillier, M.J. (1984). *Applied Mechanics*. 4th Edition; PITMAN Publisher Ltd.
- Zammit, S. J. (1987). *Motor Vehicle Engineering Science for Technicians.* 2nd Edition; UK, Longman Group UK Ltd.

TCAM 204: Technical Drawing II

Duration: 40 Hours

Module Overview

The module equips learners with the skill of interpreting and drawing various engineering parts which are used as communication media for production of engineering parts. The module introduces the learner to concepts of cam profile drawings.

Learning Outcome

By the end of this module, the learner should be able to interpret and draw correctly various cams and gears which are used as communication media for production of parts.

Preparatory Assignment

Prior to teaching this module, give learners cam data and task them to draw the follower motion graph.

Result

Let the learner draw the follower motion graph.

Sub-module 3: Cam

Duration: 10 Hours

Competences	Content	Teaching/ Learning Strategies
The learner constructs the follower motion graph and draws cam profile for the in-line follower.	• Types of cams and followers • Cam and follower motion • Construction of cam profile • Application of cams	• Illustration the construction of the follower motion graph from cam data. • Demonstrate how to draw the cam profile for the in-line follower.

Assessment Strategies

Assign the learner to construct the follower motion graph and draw cam profile for the in-line follower.

Teaching/Learning Resources

- Chalkboard
- Drawing equipment
- Tee square
- Eraser
- Charts
- Drawing board

Sub-module 4: Involutes Gears

Duration: 30 Hours

Competences	Content	Teaching/Learning Strategies
The learner determines the gear data from given parameters and constructs the involute spur gears.	• Types of involute gears • Application of the gears • Gear nomenclature • Gear calculation • Gear construction	• Illustrate how to determine the gear data from given parameters. • Demonstrate how to construct the involute spur gears.

Assessment Strategies

Assign the learner to determine the gear data from given parameters and construct the involute spur gears.

Teaching / Learning Resources

- Chalk board
- Drawing equipment
- Tee square
- Eraser
- Drawing board
- Pick and parker
- Pick Up and Parker, (1987). *Engineering Drawing with Worked Examples.* 2nd Edition; UK, Longman Group Ltd.
- Torrice, (1986). *Technical Drawing for Today*. 2nd Edition; UK, Longman Group Ltd.

TCAM 205: Real Life Project II

Duration: 40 Hours

Module Overview

This project equips the learner with practical skills in analysing design requirements, selecting materials, assembling functioning systems, selecting troubleshooting methods, dismantling and assembling machine parts to their proper functioning.

Learning Outcome

By the end of this module, the learner should be able to analyse designs, select materials, assemble functioning systems, select troubleshooting methods, dismantle and assemble machine parts to their proper functioning.

Preparatory Assignment

Before teaching this module, task learners with expert assignment at every stage of real life project.

Result

Learners do the expert assignment at every stage of real life project.

Competences	Content	Teaching/Learning Strategies
The learner: • prepares and interprets engineering drawings. • identifies materials and tools. • innovates and modifies	**Projects** • Repair and service of Starter motor • Repair and service of ECU and fuel system • Repair and service of lighting system or alarm • Repair and service of the ignition switch	• Demonstrate to learners the stages of producing the selected project beginning with simple expert example. • Guide learners on how to

Competences	Content	Teaching/Learning Strategies
components. • selects the troubleshooting methods to identify the faults. • interprets the operation manuals. • identifies materials and consumables. • selects the tools and components. • dismantles and assembles machine parts. • sustains constant maintenance of the unit. • tests and operates the transmission system. • costs and quantifies materials. • assembles components. • tests the machine. • prepares project reports.	• Repair and service of fuel gauges, air flow meter • Repair and service of generators • Repair of stripped spark plug threads • Repair and service of Manual gear box • Repair and service of Drive lines • Repair and service of a differential unit • Repair and service of an automatic gear box • Repair and service of electronic control body system • Repair and service of vehicle air conditioning , heating and ventilation system • Repair and service of Pneumatic (air) braking system • Repair and service of antilock braking system • Repair and service of Traction Control System (TCS) brakes • Repair and service of power assisted	observe health and safety and ensure security of the equipment during execution of project activities. • Guide learners on how to prepare project reports.

Competences	Content	Teaching/Learning Strategies
• observes health and safety and ensures security of the equipment during execution of project activities.	steering system • Repair and service of twin and four wheel steering • Repair and service of suspension system • Wiring of a vehicle and motor cycle • Fabrication of mechanical jack • Fabrication of vehicle guard bracket • Panel bit section of bent car NOTE: *The project(s) should be completed by the end of second year.*	

Assessment Strategy

Assign the learner to fabricate a simple component or maintain engines to good working condition.

Teaching/Learning Resources

- Writing board
- Instruments and equipment
- Safety standards
- Project materials
- Tools
- Charts
- Models
- PowerPoint

- Internet
- Chapman, J. K. (1983).*Workshop Technology*. 4th Edition; Macmillan Press Ltd.
- Gupta, G. K. (1985).*Workshop Technology*. 3rd Edition; Macmillan Press Ltd.
- Hillier, V.A.W. (1986). *Fundamentals of Motor Vehicle Technology*. 5th Edition; Macmillan Press Ltd.
- Mudd, S. C. (1986).*Technology for Motor Mechanics.* 2nd Edition; Edward Arnold (publishers) Ltd.
- Pritchard, R. T. (1979). *Technician Workshop Processes and Materials.* 3rd Edition; Hodder and Stoughton Ltd.
- Stockel, M.W. and Stockel, M. T., (1984). *Auto Service and Repair*. 4th Edition; Good Heart Willicox Company ,Inc.

Description of Year 2 Term 3

Code	Module Title	Total Hours	Hours Per
TCTM 201	Applied Technician Mathematics II	32	4
TCBE 201	Entrepreneurship Skills	24	3
TCCA 201	Basic Kiswahili	16	2
TCAM 201	Automotive Technology and Maintenance II	40	5
TCAM 202	Automotive Electric and Electronics Practice II	32	4
TCAM 203	Technician Science II	24	3
TCAM 204	Technical Drawing II	32	4
TCAM 205	Real life Project II	32	4
TOTAL		**232**	**29**
RECESS TERM			
TCAM 221: Industrial Training II		**288**	**48**

TCTM 201: Applied Technician Mathematics II

Duration: 32 Hours

Module Overview

The module introduces concepts of set theory as may be applied in grouping roofing materials and basic statistics used in recording daily progress of work on site.

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 site operation programme.

Preparatory Assignment

Learners are given different sizes of timber, such that the different sizes represent different sets.

Result

Learners present grouped sizes of timber to represent different sets.

Sub-module 7: Theory of Sets

Duration: 18 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • identifies and groups elements of a set. • analyses the difference between union, sub-sets and intersection of sets.	• Elements of sets • Union of sets	• Guide learners to identify and group elements of a set. • Lead a guided illustration on the difference between

Competences	Content	Teaching/ Learning Strategies
• applies set theory in grouping building materials. • analyses the relationship between set theory with that of ratios and proportions of building materials.	• Intersection	union, sub-sets and intersection of sets. • Demonstrate the techniques of determining the intersections, union of sets and their elements. Task learners to practise.

Assessment Strategy

Assign the learner to determine elements of sets, union of sets and intersection of sets.

Teaching/Learning Resources

- Scientific calculator
- Mathematical set
- Graph papers
- Aggregate sample
- Cement
- Mesh sieves
- Gauge box

Sub-module 8: Basic Statistics

Duration 14: Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • records information on frequency distribution sheet.	• Recording of information and	• Use illustrations to guide learners through the methods of recording

Competences	Content	Teaching/ Learning Strategies
• determines the average of given data average. • draws histograms representing given information . • applies the mean arithmetic in analysing the site activities for monthly salary and over time allowances of workers. • applies the assumed mean for calculating standard deviation of materials costs in the market.	frequency distribution • Types of average • Histograms • Calculation of mean, standard deviation and assumed mean	information on frequency distribution sheets. • Lead a guided discussion on the types of average and their importance in construction estimation. • Illustrate the representation and drawing of histograms and task learners to practice. • Guide learners through the methods of calculating mean, median, mode and standard deviation using assumed mean.

Assessment Strategy

Assign the learner to record the issuance of materials and tools from the store and illustrating it on the frequency distribution tables.

Teaching/Learning Resources

- Scientific calculator
- Mathematical set
- Graph papers
- Stroud, K.A, (2002). *Engineering Mathematics*. 4th Edition; Macmillan.
- Hancock, D. J. (1982). *Mathematics for Technicians Level 3*. Granada Technical Series

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 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 term, the learner should be able to:

- execute a contract economically and efficiently.
- save and invest in the business.
- insure the business.
- pay taxes.

Preparatory Assignment

Refer learners to a newspaper where tenders are advertised and task them to discuss the requirements to contract

Result

Learners familiarise with processes and requirements for bidding as applied to contract awards.

Sub-module 10: Contracting Process

Duration: 6 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • looks for contract information.	• Sources of contract information	• Refer learners to a newspaper where tenders are advertised and task them to discuss and

Competences	Content	Teaching/Learning Strategies
• fills and prepares a simple bid document. • complies with the contract requirements.	• Bid preparation • Contract execution and compliance	analyse the requirements to contract. • Demonstrate the procedure to be followed when preparing bid documents and guide learners to practise. • Invite a guest speaker to discuss with the learners, the bid preparation process, benefits of contract compliance. • Guide learners to discuss the procedures of contract execution.

Assessment Strategy

Assign the learner to fill a bid document in accordance with bid requirements.

Teaching/Learning Resources

- Internet
- Newspapers
- PPDA Act and Regulations,2003
- Procurement notice boards
- Standard bidding documents
- Business registration and licence certificates

Sub-module 11: Banking

Duration: 6 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • opens and manages a bank account. • acquires and services a loan.	• Services offered by Commercial banks, Micro finance institutions and SACCOs • Types of accounts (savings, current and fixed deposit) • Acquiring and servicing loans	• Guide learners in a discussion on the services offered by different financial institutions from which to source funds for the business. • Invite a guest speaker to guide learners on the procedures of getting services from financial institutions. • Using sample bank documents, illustrate the procedure of opening a bank account.

Assessment Strategies

Assign the learner to:

- open and manage a bank account.
- select the suitable financial institution to source for funds in order to boost the business.

Teaching/Learning Resources

- Bank deposit slips
- Bank withdraw slips
- Account opening forms
- Loan application forms
- Bank brochures/flyers
- Internet

Sub-module 12: Insurance for Small Businesses

Duration: 6 Hours

Competences	Content	Teaching/Learning Strategies
The learner • 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.	• Life assurance and property insurance • Principles of Insurance • Process of getting compensation	• Invite a guest speaker to discuss the life assurance, property insurance and the insurance principles. • Lead a guided discussion on the benefits of insurance. • Present a documentary of accidents at workplace and guide learners to discuss the consequences arising.

Assessment Strategies

Assign the learner to:

- examine the effectiveness of the insurance policies for small businesses.
- discuss the benefits of insuring the business.

Teaching/Learning Resources

- Claim forms

- Insurance certificates
- Insurance cards
- Worker men's Compensation Act
- Employees Standing Orders
- Internet
- Documentaries
- Insurance policies

Sub-module 13: Taxation

Duration: 6 Hours

Competences	Content	Teaching/Learning Strategies
The learner • recognises the importance of paying taxes. • identifies the taxes paid by small businesses. • calculates the tax payable. • files tax returns.	• Reasons for paying taxes • Common taxes paid by small businesses - Local service tax, - Property tax - VAT - Income tax - Market dues - Ground rent - Trade Licence • Calculating VAT and income tax payable • Filing tax returns	• Guide learners in a discussion on the benefits of paying taxes and task them to identify the common taxes paid by small businesses. • Use illustrations to guide learners on the computation of VAT and income tax. • Demonstrate the procedures followed when filing tax returns and task learners to practise.

Assessment Strategies

Assign the learner to:

- identify the common taxes payable by small businesses.
- calculate VAT and income tax payable by a projected business.

Teaching/Learning Resources

- Internet
- Computers
- Cellular phones
- Calculators
- Tax certificates
- Trading licence
- Trade competence certificate
- Business registration and licence certificates
- Uganda Revenue Authority website and portal
- Sample tax forms

TCCS 201: Basic Kiswahili

Duration: 16 Hours

Module Overview

The module equips the learner with the professional use of Kiswahili in engineering works execution and management. It helps the learner communicate to teammates who may not be familiar with the English language.

Learning Outcome

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

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

Preparatory Assignment

Take the learners to the nearest public place, workshop or industry where Kiswahili is spoken. Task the learners to ask for the names of the personnel in the place, in Kiswahili.

Result

Learners attempt to ask for the names of personnel in Kiswahili.

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

Duration: 06 Hours

Competences	Content	Teaching/ Learning Strategies
The learner : • identifies the tools and equipment and state their uses in Kiswahili. • differentiates the responsibilities and tasks performed by technicians in Kiswahili. • identifies and names the materials used in engineering.	• Names of tools and equipment used by a technician • Tasks performed by a technician • Titles of officers in woodwork • Names of materials used in woodwork	• Guide learners to identify the tools and equipment used by technicians to perform tasks by names and their application. • Lead a guided discussion on the titles and tasks performed by technicians. • Take the learners to the nearby fabrication site or workshop and task them to identify and name the materials in Kiswahili.

Assessment Strategy

Assign the learner to write the titles and tasks performed by various technicians.

Teaching/Learning Resource

The internet

Sub-module 6: Customer Care and Language

Duration: 10 Hours

Competences	Content	Teaching/ Learning Strategies
The learner : • 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.	• Attitude to customers, public and the job • Public relations and persuasive business language • Advert of products • Handling customers: welcoming them, asking whether they need help, and thanking them.	• Lead a guided discussion on the need for one to adjust his or her attitudes towards the customers, work and the general public. • Guide learners to brainstorm the importance of advertisement to any business and illustrate an advert format in Kiswahili. • Take learners to the nearby site or enterprise where Kiswahili is the main language used to transact business and task them to observe how customers are handled in Kiswahili. Task learners to write a report and present in groups.

Assessment Strategy

Assign the learner to write and format an advert for the business in Kiswahili.

Teaching/Learning Resources

- The internet
- Kiswahili dictionary
- Maw, Joan E. (1999). *Swahili for Starters. A Practical Introductory and Intermediate Level.*
- Almasi, Wared, F. (2014). *Swahili Grammar for Introductory and Intermediate Levels.*
- Biersteker, A. (1990). *Masomo ya Kisasa. Contemporary reading in Kiswahili.*

TCAM 201: Automotive Technology and Maintenance II

Duration: 40 Hours

Module Overview

This module introduces the learner to skills of troubleshooting the faults, repairing and maintenance of automatic transmission system of a vehicle. This module introduces learners to steering, braking and suspension systems to equip them with the maintenance skills.

Learning Outcome

By the end of this module, the learner should be able to troubleshoot the faults, repair and maintain automatic transmission system of a vehicle.

Preparatory Assignment

Prior to teaching this module task learners to describe the operation of power assisted steering system.

Result

Learners describe the operation of power assisted steering system.

Sub- module 10: Steering System

Duration: 6 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • describes the operation of power assisted steering system, adjusts and services	• Power assisted twin and four wheel steering	• Lead a guided discussion on the description of the operation of power assisted steering system.

Competences	Content	Teaching/Learning Strategies
steering system. • ensures safety, health and security of the environment during repair of steering system.	• Safety, health and security of the environment and steering system.	• Guide learners through practice on how to adjust and service steering system. • Guide learners on ensuring the safety, health and security of the environment during repair of steering system.

Assessment Strategy

Assign the learner to describe the operation of power assisted steering system, adjust and service steering system.

Teaching / Learning Resources

- Functioning vehicle
- Old vehicle
- Model
- Steering box
- Power steering box
- Charts
- DVD /Tapes
- Computer
- Internet

Sub-module 11: Suspension System

Duration: 14 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • identifies the main components of suspension system and maintains them to their normal function. • ensures safety, health and security of the environment during repair of suspension system.	• Hydrolastic • Air suspension/hydro-pneumatic suspension • Rubber • Safety, health and security of the environment and suspension system.	• Guide learners through practice to identify the main components of suspension system and maintain them to their normal function. • Guide learners on the Safety, health and security of the environment during repair of suspension system.

Assessment Strategy

Assign the learner to identify the main components of suspension system and maintain them to their normal function.

Teaching / Learning Resources

- Running vehicle
- Old vehicle
- Suspension rubbers
- Air suspension parts
- Hydrolastics suspension parts
- Pneumatic suspension parts
- Shock absorbers
- Working drawing
- Charts

- Video tapes
- Computer
- Internet

Sub- module 12: Braking System

Duration: 14 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • differentiates and maintains the various types of the braking systems. • ensures safety, health and security of the environment during repair of braking system.	• Pneumatic (air) • Auxiliary • Antilock Braking System • Traction-control system (TCS) • Safety, health and security of the environment and braking system.	• Lead a guided discussion on differences between the various types of the braking systems. • Guide learners through practice to maintain the various types of braking systems. • Guide learners on how to observe and ensure the safety, health and security of the environment during repair of suspension system.

Assessment Strategy

Assign the learner to differentiate and maintain the various types of the braking systems.

Teaching/Learning Resources

- Pneumatic (air)
- Auxiliary
- Antilock braking system

- Components
- Running light commercial vehicle
- Recent model (car)
- ABS system parts

Sub-module13: Vehicle Body

Duration: 6 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • identifies the main components of vehicle body systems and carries out relevant maintenance. • ensures safety, health and security of the environment during repair of vehicle body.	• Car and body technology • Air conditioning • Supplementary Restraint System • Safety, health and security of the environment and vehicle body.	• Lead learners through practice to identify the main components of vehicle body systems and carry out relevant maintenance. • Guide learners on ensuring the safety, health and security of the environment during repair of vehicle body.

Assessment Strategy

Assign the learner to identify the main components of vehicle body systems and carry out relevant maintenance.

Teaching / Learning Resources

- Running vehicle
- Old vehicle
- Recent model car
- Air bag

- Model(vehicle body)
- Transparency
- Computer
- Internet
- Hillier, V.A.W (1986).*Fundamentals of Motor Vehicle Technology*. 5th Edition; Macmillan Press Ltd.
- Mudd, S.C.(1986).*Technology for Motor Mechanics*. 2nd Edition; Edward Arnold (publishers) Ltd.
- Stockel, M.W. and Stockel, M. T. (1984). *Auto Service and Repair*. 4th Edition; Good Heart Willicox Company,Inc.

TCAM 202: Automotive Electric and Electronics Practice II

Duration: 32 Hours

Module Overview

The module equips learners with the skill of troubleshooting electrical faults, repairing and maintaining the electronic control of body systems and vehicle condition monitoring system of a vehicle.

Learning Outcome

By the end of this module the learner should be able to install electronic control body system and vehicle condition monitoring and troubleshoot the faults involved, repair and maintain it.

Preparatory Assignment

Before teaching this module, take learners to workshop and task them to operate the safety button for gear lever movement.

Result

Learners operate the safety button for gear lever movement.

Sub-module 10: Electronic Control of Body System

Duration: 18 Hours

Competences	Content	Teaching/Learning Strategies
The learner: • installs electronic control body system and troubleshoots the faults	• Trip computer • Trip electric control system • Vehicle conditioning monitoring	• Guide learners through practice on installing electronic control body system and

Competences	Content	Teaching/Learning Strategies
involved, repairs and maintains the system. • ensures safety, health and security of the environment during repair of electronic control of body system.	• Safety, health and security of the environment and electronic control of body system.	troubleshooting faults involved, repairs and maintenance. • Guide learners on the safety, health and security of the environment during repair of electronic control of body system.

Assessment Strategies

Assign the learner to install electronic control body system and troubleshoot the faults involved, repair and maintain it.

Teaching/Learning Resources

- Tool box
- Special service tools
- SST
- Chats
- Modern automotive
- Complete vehicle with electronic control of body system
- ECT type
- Special service tools

Sub-module11: Vehicle Condition Monitoring

Duration: 14 Hours

Competences	Content	Teaching/Learning Strategies
The learner : • installs vehicle condition monitoring and troubleshoots the faults involved, repairs and maintains it. • ensures health, safety and security of vehicle during repair of vehicle condition monitoring system.	• Black box technique for instrumentation • Air conditioning, heating and ventilation fault diagnosing and testing • Safety Restraint System (SRS) diagnosis and testing • Health, safety and security of environment and vehicle condition monitoring system.	• Guide learners through practice on how to install vehicle condition monitoring and troubleshoot the faults involved, repair and maintain it. • Guide learners on ensuring the health, safety and security of vehicle during repair of vehicle condition monitoring system.

Assessment Strategies

Assign the learner to install vehicle condition monitoring and troubleshoot the faults involved, repairs and maintains it.

Teaching/Learning Resources

- Safety Restraint System (SRS)
- Charts
- Simplified Circuits
- OHP

- Transparencies
- Vehicle with power seats
- Hillier, V.A.W., (1986). *Fundamentals of Motor Vehicle Technology*. 5th Edition; Macmillan Press Ltd.
- Mudd, S.C., (1986).*Technology for Motor Mechanics*. 2nd Edition; Edward Arnold (publishers) Ltd.
- Stockel, M.W.and Stockel, M. T., (1984). *Auto Service and Repair*. 4th Edition; Good Heart Willicox Company,Inc.

TCAM 203: Technician Science II

Duration: 24 Hours

Module Overview

The module equips the learners with the skill of analysing forces on vehicles and periodic motion to enable the learner select appropriate scientific concepts and principles that can be applied to solve motor vehicle related problems.

Learning Outcome

By the end of this module, the learner should be able to analyse forces on vehicles and periodic motion and select appropriate scientific concepts and principles that can be applied to solve motor vehicle related problems.

Preparatory Assignment

Before teaching this module, task learners to determine the centrifugal forces of a vehicle around the corner.

Result

Learners determine the centrifugal forces of a vehicle around the corner.

Sub-module 8: Forces on Vehicles

Duration: 16 Hours

Competences	Content	Teaching/Learnir Strategies
The learner determines the centrifugal forces of a vehicle around the corner and	• Radius of gyration • Moment of inertia • Circular motion • Centripetal, centrifugal forces and balancing • Centre of gravity above	• Illustrate how to determine the centrifugal forces of a

Competences	Content	Teaching/Learnir Strategies
carries out balancing of rotors.	ground level • Overturning on horizontal and banked tracks • Skidding on horizontal and banked tracks • Distribution and transfer of load when cornering and braking	vehicle around the corner. • Guide learners through practice on how to carry out balancing of rotors.

Assessment Strategies

Assign the learner to determine the centrifugal forces of a vehicle around the corner and carry out balancing of rotors.

Teaching/Learning Resources

- Chalk board
- Calculator
- Internet
- Transparencies

Sub-module 9: Periodic Motion

Duration: 8 Hours

Competences	Content	Teaching/Learning Strategies
The learner describes the simple harmonic motion and determines the amplitude of harmonics in the vibrating system.	• Simple harmonic motion • Frequency and amplitude • Velocity and acceleration at any instant • Variable forces producing simple harmonic motion.	• Lead a guided discussion on description of simple harmonic motion. • Illustrate to learners how to determine the amplitude of harmonics in the vibrating system.

Assessment Strategies

Assign the learner to describe the simple harmonic motion and determine the amplitude of harmonics in the vibrating system.

Teaching/Learning Resources

- Chalk board
- Calculator
- Internet
- Transparencies
- Edward. A. (1986).*Principles of Engineering Mechanics*. 2nd Edition; UK, Longman Group UK Ltd.
- Hannah, J. & Hillier, M. J. (1984).*Applied Mechanics*. 4th Edition; PITMAN Publisher Ltd.
- Zammit S. J. (1987). *Motor Vehicle Engineering Science for Technicians*. 2ndEdition; UK, Longman Group UK Ltd.

TCAM 204: Technical Drawing II

Duration: 32 Hours

Module Overview

The module equips learners with the skill of interpreting and drawing various assembled parts of a functioning unit of a machine for production of the unit. The module also introduces the learner to the technique required to draw machines and their assemblies.

Learning Outcome

By the end of this module, the learner should be able to interpret and draw correctly various assembled parts of a functioning unit of a machine for production of the unit.

Preparatory Assignment

Learners are given sections of solids for them to produce sectional views.

Result

Learners produce sectional views.

Sub-module 5: Machine Drawing Assembly

Duration: 32 Hours

Competences	Content	Teaching/ Learning Strategies
The learner: • draws assembled views in first angle and third angle orthographic projections.	• Surface texture • Assembling parts together(orthographic projection,	• Guide learners through practice on how to draw correctly assembled views in first angle and third angle

Competences	Content	Teaching/ Learning Strategies
• dimensions the assembled views using the required dimensioning technique and prints the parts list.	sectional views, dimensioning, drawing abbreviations, drawing conventions ,screws and fasteners, locking devices)	orthographic projections. • Illustrate to learners how to dimension the assembled views using the required dimensioning technique and print the parts list.

Assessment Strategy

Assign the learner to draw assembled views in first and third angle orthographic projections.

Teaching/Learning Resources

- Engineering drawing tools
- Calculator
- Engineering drawing board
- Writing boards
- Mock-ups
- Internet
- Pick Up and Parker (1987). *Engineering Drawing with Worked Examples.* 2nd Edition; Longman Group UK Ltd.
- Torrice (1986).*Technical Drawing for Today*. 2nd Edition; UK, Longman Group UK Ltd.

TCAM 205: Real Life Project II

Duration: 32 Hours

Module Overview

This project equips the learner with practical skills in analysing design requirements, selection of materials, assembling of functioning systems, selecting troubleshooting methods, dismantling and assembling machine parts to their proper functioning.

Learning Outcomes

By the end of this module, the learner should be able to analyse designs, select materials, assemble functioning systems, select troubleshooting methods, dismantle and assemble machine parts to their proper functioning.

Preparatory Assignment

Before teaching this module, task learners with expert assignment at every stage of real life project.

Result

Learners do the expert assignment at every stage of real life project.

Competences	**Content**	**Teaching/Learning Strategies**
The learner: • prepares and interprets engineering drawings. • identifies materials and tools. • innovates and	**Projects** • Repair and service of Starter motor • Repair and service of ECU and fuel system • Repair and service of lighting system or alarm • Repair and service of	• Demonstrate to learners the stages of producing the selected project beginning with simple expert example. • Guide learners

Competences	Content	Teaching/Learning Strategies
modifies components. • selects the troubleshooting methods to identify the faults. • interprets the operation manuals. • identifies materials and consumables. • selects the tools and components. • dismantles and assembles machine parts. • sustains constant maintenance of the unit. • tests and operates the transmission system. • costs and quantifies materials. • assembles components. • tests the machine. • prepares project	the ignition switch • Repair and service of fuel gauges, air flow meter • Repair and service of generators • Repair of stripped spark plug threads • Repair and service of Manual gear box • Repair and service of Drive lines • Repair and service of a differential unit • Repair and service of an automatic gear box • Repair and service of electronic control body system • Repair and service of vehicle air conditioning , heating and ventilation system • Repair and service of Pneumatic (air) braking system • Repair and service of Antilock braking system • Repair and service of Traction Control System (TCS) brakes • Repair and service of Power assisted	on the health, safety and security of the equipment during execution of project activities. • Guide learners on how to prepare project reports.

Competences	Content	Teaching/Learning Strategies
reports. • ensures health , safety and security of the equipment during execution of project activities.	steering system • Repair and service of Twin and four wheel steering • Repair and service of suspension system • Wiring of a vehicle and motor cycle • Fabrication of mechanical jack • Fabricate vehicle guard bracket • Panel bit section of bent car NOTE: *The project(s) should be completed by the end of second year.*	

Assessment Strategy

Assign the learner to fabricate a simple component according to the given drawings or maintain engines in good working condition.

Teaching/Learning Resources

- Writing board
- Instruments and equipment
- Safety standards.
- Project materials
- Tools
- Charts
- Models
- PowerPoint
- Internet

- Chapman, J. K. (1983). *Workshop Technology*. 4th Edition; Macmillan Press Ltd.
- Gupta, G. K. (1985). *Workshop Technology*. 3rd Edition; Macmillan Press Ltd.
- Hillier, V.A.W. (1986). *Fundamentals of Motor Vehicle Technology*. 5th Edition; Macmillan press Ltd.
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- Stockel, M. W. and Stockel, M. T. (1984). *Auto service and Repair*. 4th Edition; Good Heart Willicox Company, Inc

TCAM 221: Industrial Training II

Duration: 6 Weeks on Average

Module Overview

The module involves attachment of learners to garages/industries to acquire practical training in motor vehicle mechanics.

Learning Outcome

By the end of this module, the learner should be able to attain practical skills in motor vehicle mechanics.

Preparatory Assignment

Learners make a survey of possible places where they could be placed for industrial training.

Result

Learners discuss their findings with the supervisor.

Duration: 288 Hours

Competences	**Content**	**Teaching/Learning Strategies**
The learner: • observes safety at place of work. • follows instruction as prescribed. • dresses protectively at work. • measures and cuts as required. • reads and interprets manuals. • cooperates with the	**Areas of concern during industrial attachment:** • Industrial orientation • Safety at work • Working relationship • Time management • Handling of tools, machines	• Plan the schedules for IT. • Request for funds to facilitate the IT programme. • Identify industries, workshops or factories where to place

Competences	Content	Teaching/Learning Strategies
staff workers and administration body. • respects immediate supervisor at work. • keeps time, follows rules and regulations of the industry. • handles tools/equipment with care and report to the immediate supervisor for any assistance. • inquires for more information for better result and performance at work. • keeps referring to information searched for better results. • writes and presents a report. • accepts to be corrected at all times. • realises that experience is a result of hard work and enduring situations. • works under pressure especially when on industrial training. • observes health and safety, and ensures security of the equipment during IT.	and equipment • Innovation • Technical performance • Report writing • Ability to take instructions. • Ability to work under pressure. • Health , safety and security of work place	learners for IT. • Issue IT posting letters to learners. • Follow up the learners at respective industries. • Inquire from the industry administration on learners' performance. • Guide learners on how to observe health, safety and security of the equipment during IT.

Assessment Strategies

Assign the learner to:

- observe safety at place of work.
- follow instruction as prescribed.
- dress protectively at work.
- measure and cut as required.
- read and interpret manuals.
- cooperate with the staff /workers and administration body .
- respect immediate supervisor at work.
- keep time and follow rules and regulations of the industry.
- handle tools/equipment with care and report to the immediate supervisor for any assistance.
- inquire for more information for better results and performance at work.
- keep referring to information searched, for better results.
- write and present a report.
- accept to be corrected at all times and be obedient at work .
- realise that experience is a result of hard work and enduring situations.
- work under pressure especially when on industrial training.

Teaching/Learning Resources

- Workshop
- Sites
- Classroom
- Working stations
- Shops
- Industry
- Garages
- Factories

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