



**NCDC**

*NATIONAL CURRICULUM  
DEVELOPMENT CENTRE*

# National Diploma in Ceramics Engineering

## Teacher's Guide to the Teaching Syllabus



**THE REPUBLIC OF UGANDA**  
Ministry of Education and Sports





# National Diploma in Ceramics Engineering

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**THE REPUBLIC OF UGANDA**  
Ministry of Education and Sports

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# Contents

Foreword	IX
Acknowledgement	X
List of Acronyms	XI
Introduction	1
Aims of the Curriculum	1
Organisation of the Teacher's Guide	2
How to Use the Teacher's Guide	3
How to Use the Participatory Methods in the Guide	4
Programme Structure	10
Year 1 Semester 1	13
TDEM 111: Engineering Mathematics (I)	13
Sub-module 1: Element of Mathematics	13
Sub-module 2: Polynomial	14
Sub-module 3: Vector Analysis	15
Sub-module 4: Indices	16
Sub-module 5: Logarithms	17
Sub-module 6: Linear Algebra	18
Sub-module 7: Trigonometry	19
TDIT 117: Computer Applications	20
Sub-module 1: Introduction	20
Sub-module 2: MS Word	21
Sub-module 3: MS Power Point	24
Sub-module 4: MS Excel	25
Sub-module 5: MS Access	26
Sub-module 6: Internet	27
TDCH 111: Communication Skills	28
Sub-module 1: Introduction to Communication Skills	28
Sub-module 2: Writing Skills	30
Sub- module 3: Oral Communication Skills	31
Sub-module 4: Trade Specific Communication	32
Sub-module 5: Social Affairs	33
Sub-module 6: Civic Education	35
TDME 114: Engineering Drawing	37
Sub-module 1: Introduction to Drawing	37
Sub-module 2: Simple Geometrical Constructions	38
Sub-module 3: Principles of Tangency	39
Sub-module 4: Simple Plane Figures	40
Sub-module 5: Transformation of Plane Figures	41
Sub-module 6: Loci and Special Curves	42
Sub-module 7: Principles of Orthographic Projection	42
Sub-module 8: First Auxiliary Projection	44

Sub-module 9: Sectional Views _____	45
Sub-module 10: Isometric and Oblique Projection _____	46
TDCR 111: Ceramic Technology I _____	47
Sub-module 1: Introduction to Ceramic Raw Materials _____	47
Sub-module 2: Ceramic Products _____	48
Sub-module 3: Winning _____	49
Sub-module 4: Body Preparation _____	50
NDCR 112: Ceramics Chemistry I _____	51
Sub-Module 1: Introduction _____	51
Sub-module2: Structure and Bonding _____	52
Sub-module3: States of Matter _____	54
Sub-module4: Colloidal State of Matter _____	55
Sub-module 5: Chemical Equilibrium in Aqueous Solution _____	56
Sub-module 6: Organic Chemistry and Polymers _____	57
TDCR 113: Real Life Project _____	58
Sub-module 1: Introduction to Ceramic Raw Materials _____	58
Sub-module 2: Single Body Preparation _____	59
Sub- module 3: Elementary Shaping Methods _____	60
Sub-module 4: Biscuit Firing _____	61
Detailed Modules Description of Year 1 Semester 2 _____	62
TDEM 121: Engineering Mathematics II _____	62
Sub- module 1: Complex Numbers _____	62
Sub-module 2: Hyperbolic Function _____	63
Sub-module 3: Differential Calculus _____	64
Sub-module 4: Integral Calculus _____	65
Sub-module: 5 Ordinary Differential Equations _____	66
TDCR 121: Ceramic Technology II _____	67
Sub-module 1: Physical Tests and Chemical Tests _____	67
Sub-module 2: Drying and Dryer _____	68
Sub- module 3: Firing and Kilns _____	69
Sub-module 4: Fundamentals of Glazes _____	70
TDCR 122: Materials Science 1 _____	72
Sub-module 1: Classification of Ceramic Materials _____	72
Sub-module 2: Plastics _____	73
Sub-module 3: Metals (Ferrous and Non- Ferrous Metals) _____	75
Sub-module 4: Concrete Products _____	77
Sub-module 5: Mortars _____	77
Sub-module 6: Lime _____	78
Sub-module 7: Cement _____	79
Sub-module 8: Ceramics _____	80
TDCR 123: Environmental Science and Safety _____	82
Sub-module 1: Pollution Science _____	82
Sub-module 2: Environment Toxicology and Pollution _____	83

Sub-module 3: Industrial Effluents _____	84
Sub-module 4: Safety and Security _____	85
TDCR 124: Ceramic Design _____	86
Sub-module 1: Introduction Ceramic Design _____	86
Sub-module 2: Design Factors _____	87
Sub-module 3: Function of Design _____	88
Sub-module 4: Types of Design _____	88
NDCME 125: Real Life Project II _____	90
Sub-module 1: Body Preparation _____	90
Sub-module 2: Throwing Cylinders _____	91
Sub-module 3: Throwing of Simple Articles _____	92
Sub-module 4: Production of Plaster Moulds _____	93
Sub-module 5: Biscuit Firing _____	93
TDCR 131: Industrial Training 1 _____	94
Description of Year 2 Semester 1 _____	96
TDEM 211: Engineering Mathematics III _____	97
Sub-module 1: Sequence and Series _____	97
Sub-module 2: Probability Theorem _____	98
Sub-module 3: Statistics _____	99
TDWE 211: Geology and Soils _____	100
Year 2 Semester 1 _____	100
Sub-module 1: Introduction to Geology _____	100
Sub-module 2: Structural Geology _____	101
Sub-module 3: Elementary Mineralogy _____	102
Sub-module 4: Origin, Classification and Properties of Rocks _____	103
Sub-module 5: Weathering and Denudation _____	104
Sub-module 6: Site Investigation _____	105
TDAR 211: Computer Aided Design _____	107
Sub-Module 1: Introduction _____	107
Sub-module 2: File Management _____	108
Sub-module 3: Drawing _____	109
Sub-module 4: Methods for Viewing Drawing _____	110
Sub-module 5: Dimensioning _____	110
Sub-module 6: Modifying a Drawing _____	111
Sub-module 7: Production of Architectural Drawing _____	111
Sub-module 8: Plumbing and Sanitation Details _____	112
NDCME 211: Ceramics Technology III _____	114
Sub-module 1: Body preparation _____	114
Sub-module 2: Casting slip _____	115
Sub-module 3: Heavy Clay Ware _____	116
Sub-module 4: Firing of Heavy Clay Ware _____	117
Sub-module 5: Refractories and Insulators _____	117
TDCR 212: Materials Science II _____	119

Sub-Module 1: Properties of Materials	119
Sub-module 2: Mechanical Behaviour	120
Sub-Module 3: Electrical Properties	121
Sub-module 4: Mechanical Properties of Ceramics	122
Sub-module 5: Optical Properties of Ceramics	123
TDCR 213: Ceramics Calculations	124
Sub-module 1: Elementary Calculations	124
Sub-module 2: Porous Solids	125
Sub-Module 3: Suspensions	126
Sub-Module 4: Body Calculation	127
Sub-Module 5: Glaze Calculations	128
Sub-module 6: Slip	129
TDCR 214: Ceramics and Concrete Works	130
Sub-module 1: Introduction	130
Sub-module 2: Materials for Concrete	131
Sub-module 3: Water and Concrete Mix Design Water and Concrete Mix Design	132
Sub-module 4: Formwork	133
Sub-module 5: Concreting Process	134
Sub-module 6: Protecting Concrete during Casting	135
Sub-module 7: Pre-cast Concrete and Products	137
TDCR 215: Real Life Project III	138
Sub-Module1: Body Preparation for Filter Pressing	138
Sub-module 2: Throwing	139
Sub-module 3: Preparation of Casting Slip	140
Sub-module 4: Slip and Hard Casting	141
Sub-module 5: Biscuit Firing	142
description of Year 2 Semester 2	143
TDCH 221: Kiswahili	144
Year 2 Semester 1	144
Sub-module 1: Introduction	144
Sub-module 2: Polite Language	145
Sub-module 3: General Vocabulary	145
Sub-module 4: Specific Trade (professional related) Vocabulary	146
Sub-module 5: Customer Care and Language	147
Sub-module 6: Presentations in Kiswahili	147
TDCH 222: Entrepreneurship Skills	149
Sub-module 1: Entrepreneurship Development	149
Sub-module 2: Uganda's Experience	150
Sub-module 3: Entrepreneurship Process	151
Sub-module 4: Employment Creation	151
Sub-module 5: Marking New Ventures	152
Sub-module 6: Managing a Business Enterprise	153



Sub-module 7: Financial Management and Cost Accounting Systems	154
NDCR 221: Ceramic Technology IV	155
Sub-module 1: Introduction to Enamels on Metals	155
Sub-module 2: Introduction to Decorative Processes	156
Sub-module 3: Glazes	157
Sub-module 4: Practical Application of Glazes	158
Sub-module 5: Practical Glost Firing	159
TDCR 222: Ceramic Chemistry II	160
Sub-module 1: Introduction and Fundamental Concepts	160
Sub-module 2: Atomic Structure	161
Sub-module 3: Chemical Bond	162
Sub-module 4: Water	163
Sub-module 5: Acids, Bases and Salts	163
Sub-module 6: Oxidation and Reduction	164
Sub-module 7: Nuclear Chemistry	165
Sub-module 8: Plastics and Polymers	166
Sub -module 9: Paints, Varnishes and Distemper	166
Sub-module 10: Refractory Materials and Abrasive	167
Sub-module 11: Fuels and Combustion	168
TDCR 222: Glass Technology	169
Sub-module 1: Feldspar	169
Sub-module 2: Glass Sand and Limestone	170
Sub-module 3: Dolomite and Cryolite	171
Sub-module 4: Constituent Materials	171
Sub-module 5: Potassium Carbonate	172
Sub-module 6: Composition of Various Glasses	173
Sub-module 7: Nuclear Chemistry	174
Sub-module 8: Preparation of Glass Batch	175
TDME 227: Industrial Organisation and Management	176
Sub-module 1: Management Principles	176
Sub-module 2: Preliminary Factory Set-up	178
Sub-module 3: Safety, Health and Welfare	179
Sub-module 4: Important Factory Documents	181
Sub-module 5: Management of Materials	182
Sub-module 6: Manufacturing Plant and Equipment	183
Sub-module 7: Labour Management	184
Sub-module 8: Workshop Control	185
Sub-module 9: Safety and Security in Industries	186
Sub-module 10: Welfare in Industries	187
Sub-module 11: Environmental Consideration in Industries	188
Sub-module 12: Construction and Related Laws	189
TDCR 224: Foundry (Casting)	190
Year 1 Term 2	190

Sub-module 1: Introduction to Foundry Work_____	190
Sub-module 2: Sand Casting_____	191
NDCME 231: Industrial Training 11 _____	193
Appendix I: Bibliography _____	195
Appendix 2: Software _____	197
Appendix 3: Tools and Equipment _____	198

# Foreword

One of the strategies of the Ministry of Education and Sports (MoES) is to improve the curricula for technical and vocational education diploma programmes. Technical Colleges are the highest level of training of technicians in the country. In line with its emphasis on science and technology for transforming society, the Government of Uganda aims at providing technical, scientific and vocational skills for Uganda's technicians. This curriculum is learner-centred and competence-based, and is updated with current labour market demands. It focuses on core tasks and assignments. It begins with a preparatory assignment and each semester 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 (WoW) which included employers and graduates of technical diploma programmes. A report from the survey culminated in the development of a Professional Profile which includes all jobs and tasks that the graduates of technical diploma programmes perform. This laid the foundation for developing all the modules in this curriculum.

This curriculum aims at making Uganda Technical Colleges (UTCs) and other Tertiary Institutions the centre of excellence for technical education in the region, which will lead to a greater development and industrialisation of the country.

***Connie Kateeba***

***Director***

***National Curriculum Development Centre***

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Furthermore, NCDC wishes to acknowledge the historic contributions of City and Guilds of London Institute, East African Examinations Council and Uganda National Examinations Board because they are the foundation on which technical education is built.

NCDC consulted and reached a consensus on all issues with the stakeholders during development of this curriculum. In this regard, great thanks go to the Directorate of Industrial Training (DIT) who provided the Professional Profile through Assessment Training Packages (ATPs).

We also wish to acknowledge the Uganda Technical Colleges (UTCs), Kyambogo University, Kyambogo Engineering Services (KES), the Ministry of Education and Sports, Uganda Business and Technical Examinations Board (UBTEB) and the Directorate of Education Standards (DES) for providing the manpower for developing this curriculum.

## List of Acronyms

BOQ	Bill of Quantities
CD	Curriculum Development
DES	Directorate of Education Standards
NDCR	National Diploma in Ceramics Engineering
TFCDD	Task Force for Curriculum Development
CGPA	Cumulative Grade Point Average
CH	Contact Hours
CTF	Curriculum Task Force
CU	Credit Units
DIT	Directorate of Industrial Training
GP	Grade Point
HDME	Higher Diploma in Mechanical Engineering
KES	Kyambogo Engineering Service
LH	Lecture Hours
MOES	Ministry of Education and Sports
MOLGSD	Ministry of Labour, Gender and Social Development
NCDC	National Curriculum Development Centre
NCHE	National Council for Higher Education
NDME	National Diploma in Mechanical Engineering
NGO	Non-Governmental Organisation
NP	Normal Progress
NVQ	New Vocational Qualification
PH	Practical Hours
PP	Probationary Progress
TD	Technical Diploma
UNEB	Uganda National Examinations Board
UTC	Uganda Technical College
WOW	World of Work



## Introduction

This Teacher's Guide is aimed at enhancing the teacher's methods of conducting training sessions here referred to as teaching and learning strategies; by ensuring that the required competences are imparted to the learner. The teacher concerned should, therefore, ensure that the learner fully participates in the lesson.

## Aims of the Curriculum

This is a competence based education and training (CBET) curricula is aimed at:

- 1) equipping the learner with practical skills relevant in solving the day-to-day societal needs.
- 2) equipping learner with the skills and knowledge of creating more jobs and reducing the rate of unemployment.
- 3) equipping the learner with creative and innovative thinking to enhance research of yet undiscovered potential resources.
- 4) giving the learner knowledge of analysing events and situations so as to come up with new discoveries.
- 5) giving the learner knowledge and skills of marketing their enterprises and lobbying for any form of support.
- 6) giving the learner the knowledge and skills that enable him/her to vertically upgrade to higher levels of education.
- 7) equipping the learner with skills and knowledge of interpersonal communication.
- 8) equipping the learner with basic Kiswahili that will widen his/her employment opportunities in the whole of the East African Community member countries.
- 9) instilling in the learner and the public the attitude change and understanding of technical education not for academic failures but for more creative and gifted persons.
- 10) informing politicians, educationists, social workers, industrialists and all stake-holders that, without graduates of this course, the citizens embracing and investing in technical, science and research, our country will remain poor.

## Organisation of the Teacher's Guide

### Module Code and Name

This shows the identification number and name of the module in the particular year of study.

### Module

This is simply the subject of study in the specified duration. It has particular competences that the learner is expected to acquire at various levels during the course of study.

### Module Level

This notifies the Instructor which type of learner he/she is leading to skills attainment i.e. in year one or year two.

### Duration

This is the suggested time allocation for a given module within a specific semester.

### Module Overview

This contains the general introduction of the content in the module.

### Module Learning Outcome

This represents the general learning objective of a given content in the module. It clarifies generally what the learner should be able to do as a result of passing through the teaching and learning processes.

### Preparatory Assignment

This is the realistic guide to the Instructor, mainly on the way he/she should introduce the module content to stimulate the learner's curiosity to studying the module. It directs the Instructor on how he/she can directly inspire the learner to like the 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 the learner relate what he/she is going to study with the reality in the world of work.

### Result

This is the outcome of the preparatory assignment. Each preparatory assignment must have results indicating the learner's participation as this becomes the first basis for assessing the learner's knowledge level in relation to the module content.



### **Sub-Module**

This is representation of a topic with its content.

### **Competences**

These are specific skills which the learner is expected to acquire and perform, after every training session of the specific module content.

### **Content**

This is the outline of what is to be taught in the particular sub-module.

### **Teaching Strategies**

These are teaching guidelines on all content and are intended to help the Instructor to plan and carryout work effectively. The list, however, is not in any way exhaustive and the Instructor is expected to be innovative. He/she should therefore exploit the relevant learning environment outside the classroom.

### **Assessment Strategies**

These are tasks for evaluating the learner's performance. As much as possible, the Instructor should desist from using only one assessment strategy. The learner should use different learning styles and it is only fair that he/she is assessed for the cognitive, affective and psychomotor abilities.

The Instructor should not only assess the theory and practical work done in the classroom but also other aspects covered outside the classroom. The learner's logbooks for example, are a useful follow-up means on practical and project work, and industrial training.

### **Resources**

These are teaching aids and are necessary for the success of effective teaching/learning process. The Instructor ensures as much as possible the use of many real objects as resources to simplify learning. He/she is not restricted to the resources stated in this guide; but has the freedom to be innovative and use others available in the learning environment according to content.

## **How to Use the Teacher's Guide**

This Teacher's Guide should be used concurrently with the syllabus and the suggested teaching resources and relevant textbooks. For proper implementation of this Teacher's Guide, the Instructor is expected to:

1. guide the learner through the proposed resources or use his/her own innovated preparatory assignment, as an orientation to the learner.
2. actively participate, guide and stand as a role model for the learner to appreciate his/her choice in joining the world of technology.

3. relate the competences and the teaching strategies in line with the extracted content, and refer to the corresponding teaching resources.
4. re-divide the total given time per sub-module to suit all the outlined contents.
5. involve the learner in creative and innovative participation during the teaching and learning process.
6. assess the learner in accordance with his/her participation and assignments administered. This forms part of the continuous assessments of the learner.
7. guide the learner to effectively use the outlined teaching and learning resources to perform the module competences. He/she is at liberty to innovatively generate other resources for teaching/ learning in addition to the ones outlined.

### **Rationale**

This Teacher's Guide is meant to facilitate the Instructor to interpret and use the syllabus to deliver a more updated and relevant content effectively to the learner. It outlines the methods you may use, the procedures to be taken, and the assessment and evaluation techniques.

Thus the Teacher's Guide is an essential tool-kit or requirement for the success of the teaching /learning process of a Diploma in Ceramics Engineering syllabus.

### **Methodology**

The suggested teaching methods given in this guide are the basic minimum. You have the discretion to apply any suitable method(s). The type of method to be used is dictated by the competences that are to be acquired by the learner.

Furthermore, the Instructor should be able to develop more forms of introduction for a sub-module to capture the learner's attention, which may include: short story; oral review linking the past to present work; short written quiz; statement of what the lesson is about; presentation of a problem to the learner; displaying a chart/drawing/specimen/picture; providing a case study; showing a film or listening to a short recording.

## **How to Use the Participatory Methods in the Guide**

You are encouraged to select an appropriate teaching method depending on the module activity. For example:

## **Discussion**

The learners in groups:

- talk about the assigned activities and reports back.
- display work to members in other groups to read and capture points for discussion.
- critiques each other.

The Instructor summarises the session by drawing on the main points.

## **Demonstration /Illustration**

This is the presentation of ideas, skills, attitudes, norms and processes. It involves a series of well-planned actions designed to illustrate a phenomenon.

It has three phases:

### ***Phase 1: Planning***

- i) Selecting a skill or an activity which the learner needs from a given module or topic. This should be relevant in developing competences in the learner.
- ii) Being knowledgeable about the skill.
- iii) Being able to perform it yourself or using an expert.
- iv) Carefully determining the materials or equipment needed and ready for use.
- v) Arranging the materials/equipment in order of how you are going to use them.
- vi) Observing safety regulations for handling materials or equipment.
- vii) Informing the learner of the importance of the activity.
- viii) Explaining the use of various materials and equipment.
- ix) Listing down the steps/procedures in this activity.
- x) Explaining content verbally then doing it physically.
- xi) Letting the learner repeat the procedure as you supervise.
- xii) Asking questions to draw attention to crucial steps.
- xxiii) Following up with a discussion.

### ***Phase 2: Discussion***

Using some guiding questions, provide summary and main points that must be remembered or adhered to.

### ***Phase 3: Presentation***

- i) Tell the learner the importance of what he/she is to benefit.
- ii) Show the materials or equipment/parts.
- iii) State the maintenance procedures, safety precautions, and current market price, where to obtain it from, type and specifications/size being used.

- iv) Arrange the learner in a horse shoe or U-setting so that you maintain eye contact with each of them.
- v) Show the learner the normal speed of doing the task.
- vi) Repeat the task slowly with necessary comments.
- vii) Ask the learner to individually perform the task while others watch.
- viii) Summarise the key steps in the task.

### **Practical/Experimentation**

- Experiments must be done individually by each learner. You must carry out the experiment two days before the learner is allowed to perform the same experiment. Where materials are not enough, then each learner can perform a different experiment at a time but rotate from one station to another.
- During the first time in the laboratory, the learner should be made to go through the safety precautions.
- Supervise the experiments being done by the learner to:
  - a) detect any mistakes and help to correct them.
  - b) check the pace of performing the task.
  - c) have laboratory/workshop report books to keep record of all practical work.
  - d) refer the learner to the institute workshop, sites or the surrounding workshops/sites for materials to be used in the practical and experiments.

## **Brainstorming**

This is a way of obtaining as many views as possible from the learner in a short time. The learners in small groups or whole group are led into giving as many ideas as they can think of on a particular topic/module.

- Accept all ideas without challenging or questioning.
- Group or classify the ideas given.
- Rank them. Ranking is a way of deciding the aspects that are more important and giving reasons for your decision.

## **Project**

This is to allow the learner to carry out investigations and innovations in engineering independently or in groups. It gives chance to the learner to put into practice what has been taught in class. The projects must be based on solving an existing or foreseen problem(s).

The project method has four phases namely:

### ***Phase 1: Planning***

The learner should be organised to work as an individual or in small groups of not more than 5. He/she should then be guided to choose the project title from a real life experience.

The guidelines for choosing a project title should be based on:

- i) modules to be covered
- ii) facilities available for use
- iii) specific societal problem being addressed

The learner should be clear on the purpose and should write down the objectives to be achieved through carrying out the project.

## **Guide**

### ***Phase 2: Activities***

The following procedure may be used:

- i) The learner makes a work plan for the chosen project.
- ii) The Instructor assess the work plan to check the appropriateness of the topic, method, equipment, materials as well as time allocation for each stage; research made in books, magazines, Internet, journals, etc.
- iii) The learner starts working on the project and makes accurate observations on the progress.
- iv) The Instructor supervises the work and receives progressive reports at agreed timeline.
- v) The learner identifies new challenges and experiences to be documented.
- vi) The learner prepares project report.

**Phase 3: Presentation**

A good class or project presentation should include the following:

- Topic name or project title
  - Aims and objectives of the investigation/task/design/fabrication
  - Methods employed and reasons for adoption of those methods
  - Apparatus/equipment or materials used including all illustrations, results in form of tables, graphs, pie charts and photos
  - Interpretation of findings
  - Discussion of findings including performance, errors made and explanation for these errors, ways challenges were overcome as well as suggestions for future investigation/designs
- vii) Conclusions reached of the project and a tangible product/output

**Phase 4: Assessment**

This should be based on:

- i) ability to apply scientific knowledge, experience or practical skills to improve production.
- ii) of sensible scientific skills or application in the choice of method used, objectivity in interpreting findings, exhibition of project products and drawing of conclusion.
- iii) critical evaluation of results and procedure used.

**Field Trip/Visits**

This involves the learner going out to the field/site/industry to learn in another unusual/ familiar environment. It involves risk-taking, accessing knowledge by being present and adventurous.

- i) Brief the learner on the details of the trip he/she is to make stating location, time, purpose/objectives and expectations.
- ii) Develop a list of questions and requirement.
- iii) Encourage other staff members to accompany the learner.
- iv) Have a follow-up to discuss and critique the trips.

**7. Guided Discovery**

This is where the teaching is based on the notion that the learner knows more but he/she does not know it, so he/she only needs to be guided in his/her environment to discover new knowledge. It can help them make personal assessment.

**Procedure of Using the Methodology**

The suggested steps of presentation will guide the teacher in the flow of the content delivery. However, any necessary alteration in the order of presentation is possible.

It is important that the teacher organises educational visits, projects and field attachments to resourceful sites in order to enhance the teaching-learning process.

## Programme Structure

The National Diploma in Ceramics Engineering is based on a semester system. During each semester, a core project or assignment is accomplished. The competence-based education is based on core tasks and projects, and starts with preparatory assignments that prepare the learner for the module and relate the module to the core task.

Each module contains sub-modules, each of which includes a practical assignment that will help the learner perform the core task. The modules undertaken during a given semester are aimed at providing:

- applied theory
- technical and practical skills
- professional attitude

These modules support or make it possible to perform the core task or assignment. The learner has to carry out a real life project to put into practice the knowledge and skills acquired.

### Year 1 Semester 1

<b>Semester 1: Core Task</b>					
<b>Code</b>	<b>Module Title (All core modules)</b>	<b>L</b>	<b>P</b>	<b>CH</b>	<b>CU</b>
TDEM 111	Engineering Mathematics I	60	0	60	4
TDIT 117	Computer Applications	30	30	45	3
TDCH 111	Communication Skills	30	30	45	3
TDME 114	Engineering Drawing	30	30	45	3
TDCR111	Ceramic Technology I	45	30	60	4
TDCR112	Ceramics Chemistry I	30	30	45	3
TDCR113	Real Life Project I	0	120	60	4

### Year 1 Semester 2

<b>Core Project(s) :</b>					
<ul style="list-style-type: none"> <li>• <b>Production of plaster mould</b></li> <li>• <b>Production of complex pieces on a potters' wheel</b></li> </ul>					
<b>Code</b>	<b>Module Title (All Core Modules)</b>	<b>L</b>	<b>P</b>	<b>CH</b>	<b>CU</b>
TDEM121	Engineering Mathematics II	60	0	60	4
TDCR 121	Ceramics Technology II	45	30	60	4
TDCR 122	Materials Science I	30	30	45	3
TDCR 123	Environmental Science and Safety	30	30	45	3
TDCR 124	Ceramics Design	30	30	45	3
TDCR	Real Life Project II	0	120	60	4



125					
	<b>Total</b>	<b>240</b>	<b>240</b>	<b>360</b>	<b>24</b>
<b>Semester Load = 24</b>					
<b>Industrial Training Term (Core Module)</b>					
<b>Code</b>	<b>Module Title</b>	<b>L</b>	<b>P</b>	<b>CH</b>	<b>CU</b>
TDCR 131	Industrial Training I	0	360	45	3

## Year 2 Semester 1

<b>Semester I: Core Project(s):</b>					
<ul style="list-style-type: none"> <li>Construction of a kiln using local materials</li> </ul>					
<b>Code</b>	<b>Module Title (All Core Modules)</b>	<b>L</b>	<b>P</b>	<b>CH</b>	<b>CU</b>
TDEM 211	Engineering Mathematics III	60	0	60	4
TDWE 211	Geology and Soils	30	30	45	3
TDAR 211	Computer Aided Design	30	30	45	3
TDCR 211	Ceramics Technology III	30	30	45	3
TDCR 212	Materials Science II	30	30	45	3
TDCR 213	Ceramics Calculations	30	30	60	3
TDCR 214	Ceramics Concrete Works	30	30	45	3
TDCR 215	Real Life Project III - Kiln Construction	0	120	60	4
<b>Total</b>					<b>26</b>
<b>Semester Load = 26</b>					

## Year 2 Semester 2

<b>Semester II Core Project(s):</b>					
<ul style="list-style-type: none"> <li>Production, preparation and application of glazes.</li> <li>Construction of a simple bio-gas plant</li> <li>Production of energy saving stoves</li> </ul>					
<b>CODE</b>	<b>MODULE TITLE (All Core Modules)</b>	<b>L</b>	<b>P</b>	<b>CH</b>	<b>CU</b>
TDCH 221	Kiswahili	30	30	45	3
TDCH 222	Entrepreneurship Skills	30	30	45	3
TDCR 221	Ceramics Technology IV	30	30	45	3
TDCR 222	Ceramics Chemistry II	30	30	45	3
TDCR 223	Glass and Technology	30	30	45	3
TDCR 224	Foundry	30	30	45	3
TDME 227	Industrial Organisation and Management	45	0	45	3
TDCR 227	Real Life Project IV	0	120	60	4
<b>Total</b>					<b>25</b>

<b>Semester Load = 25</b>					
<b>Industrial Training Period (Core Module)</b>					
<b>Code</b>	<b>Module Title</b>	<b>L</b>	<b>P</b>	<b>CH</b>	<b>CU</b>
<b>TDCR 231</b>	Industrial Training II	0	360	45	3
<b>Total Year II Credits = 55</b>					

# Year 1 semester 1

## TDEM 111: Engineering Mathematics (I)

Duration: 60 Hours

### Module Overview

This module equips the learner with approaches and application of Engineering Mathematics and its importance in analysing ceramic properties.

### Learning Outcome

By the end of the module the learner should be able to batch and mix ceramic materials using the set theory.

### Preparatory Assignment

Before teaching this module, lead the learner through open discussions on the importance of Engineering Mathematics, its relevance to the field of ceramics; relate it to the application in set theories applied in batching ceramic materials.

### Result

The learner shares his/her experience, appreciates the need to study Engineering Mathematics and prepares himself/herself for the module.

## Sub-module 1: Element of Mathematics

Competences	Content	Teaching Strategies
The learner applies set theory during the batching of mortar and concrete ingredients.	<ul style="list-style-type: none"> <li>Set theory</li> <li>Theory of relations and functions</li> <li>Number theory</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on set theory.</li> <li>Illustrate the manipulation of number theory, set theory.</li> <li>Demonstrate the performance of number theory.</li> </ul>

### Assessment Strategy

The learner takes an assignment on number theory and set theory.

### Resources

Scientific calculator

## Sub-module 2: Polynomial

Duration: 8 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>draws graphs for a linear, polynomial function.</li> <li>determines roots of polynomials from graphs.</li> <li>solves linear, polynomial functions using graphical and analytical methods to locate a point of contraflexure of uniformly varying load of a beam.</li> <li>changes algebraic fractions into partial fractions.</li> <li>solves and applies simultaneous equations to evaluate engineering problems.</li> <li>applies the general quadratic equations formula.</li> <li>solves quadratic equations with roots.</li> </ul>	<ul style="list-style-type: none"> <li>Linear functions, graph of functions, roots, partial fractions.</li> <li>Factorisation of quadratic polynomials</li> <li>Simultaneous equations</li> <li>General quadratic equations</li> </ul>	<ul style="list-style-type: none"> <li>Guide the learner to draw graphs of polynomial functions.</li> <li>Lead the learner in solving linear equations in relation to the law of machine and drawing of linear graphs.</li> <li>Demonstrate the manipulation of algebraic fractions into partial fractions.</li> <li>Demonstrate on the graph how to determine the roots of polynomials.</li> <li>Demonstrate how to use the roots to evaluate a given polynomial function.</li> <li>Lead a guided discussion on various approaches in solving simultaneous and quadratic equations.</li> <li>Lead a guided discussion on how to apply simultaneous equations in solving engineering problems.</li> <li>Demonstrate how to derive the quadratic equation general formula.</li> <li>Lead the learner through practice, the application of the general quadratic equations formula to solve equations with complex roots.</li> </ul>

### Assessment Strategies

The learner:

- uses the various approaches to solve polynomials, simultaneous and quadratic equations.
- does classwork on remainder theorem and polynomial equations.

## Sub-module 3: Vector Analysis

Duration: 8 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>• represents vectors in terms of components of vectors and unit vector.</li> <li>• applies laws of vector algebra for analytical and geometrical solutions in determining a force of members in frame works.</li> <li>• applies vector equations to determine the motion and direction of revolving concrete mixer and lifting cranes.</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction to vector representations</li> <li>• Manipulation of vectors and scalar products</li> <li>• Laws of vector algebras</li> <li>• Application to analytical geometry involving vectors</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate how to write vectors in terms of components of vectors and unit vector</li> <li>• Illustrate the methods of manipulating vectors and scalar products, and the application of laws of vector algebra.</li> <li>• Demonstrate the application of laws of vector algebra to analytical geometry.</li> <li>• Guide the learner to evaluate the scalar and dot product.</li> <li>• Guide the learner, with practical demonstrations on the application of vector algebra for analytical and geometrical solutions.</li> </ul>

### Assessment Strategies

The learner:

- does classwork on laws of vector algebra.
- does exercise on the evaluation of the scalar and dot product.
- does exercise on application of vector algebra for analytical and geometrical solutions.

## Sub-module 4: Indices

Duration: 8 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>illustrates laws of indices to simplify algebraic expressions.</li> <li>describes and applies laws of indices to simplify algebraic expressions.</li> <li>applies rational indices during the designing and shaping of water facilities.</li> <li>solves simple indicial equations.</li> </ul>	<ul style="list-style-type: none"> <li>Definitions</li> <li>Laws of indices</li> <li>Fractional indices</li> <li>Negative indices</li> <li>Multiplication and Division</li> <li>Rationalisation</li> </ul> <ul style="list-style-type: none"> <li>Equations involving Indices</li> </ul>	<ul style="list-style-type: none"> <li>Guide the learner on the introduction of indices and their representations.</li> <li>Guide the learner on the methods of multiplying, dividing, adding and subtracting indices.</li> <li>Organise the learner in groups and guide them to practice solving of simple indicial equations.</li> </ul>

### Assessment Strategies

The learner:

- does classwork on rationalisation and division of indices.
- does group assignments to solve simple indicial equations.

## Sub-module 5: Logarithms

Duration: 6 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>describes and applies laws of logarithms to simplify and evaluate equations involving logarithms.</li> <li>solves equations involving logarithmic functions and exponential functions.</li> <li>draws logarithmic graphs.</li> </ul>	<ul style="list-style-type: none"> <li>Theory of logarithms, common logarithm, equations involving logarithms</li> <li>Logarithmic functions</li> <li>Exponential functions and logarithmic graphs</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on : Logarithmic equation.</li> <li>Illustrate on board the skills of correcting figures to significant places.</li> <li>Guide the learner on the use of scientific calculators and logbooks to solve equations involving logarithmic functions and exponential functions.</li> <li>Engage the learner on Group discussion on logarithmic graphs and their illustration.</li> </ul>

### Assessment Strategies

The Learner:

- does a class exercise on logarithmic equations and corrects figures to significant places.
- illustrates the logarithmic graphs in groups.
- correctly uses the scientific calculators to search for solutions to logarithms.

### Resources

- Chalkboard
- Log tables
- Scientific calculator
- instruments
- Graph papers
- Drawing

## Sub-module 6: Linear Algebra

Duration: 8 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>calculates algebra of a matrix and applies it to solve a system of equations using various methods in determining the branch currents in a parallel circuit and heat transfer in parallel composite walls.</li> <li>determines Eigen values and vectors for a given matrix, applies matrices in organising collected bulk field data into rows and columns for simple interpretation. When finding the direction and magnitude of a system of forces.</li> <li>applies properties of determinants, minors and cofactors, classical adjoint, Cramer's rule, Eigen values and vectors to solve engineering problems.</li> </ul>	<ul style="list-style-type: none"> <li>Systems of linear equations, vector space and sub-spaces, bases and dimensions, linear dependence</li> <li>Matrix algebra, identities, and systems of linear equations</li> <li>Elementary row operations and echelons.</li> <li>Transpose in matrices</li> <li>Determinants and their properties</li> <li>Minors and cofactors, classical adjoint, crammers rule Eigen values and vectors</li> </ul>	<ul style="list-style-type: none"> <li>Guide on raw and column matrices.</li> <li>Demonstrate how to solve systems of linear equations, vector spaces and subspaces, basis and dimension, linear dependence.</li> <li>Lead the learner's in group discussions to calculate algebra of a matrix, by addition, subtraction and multiplication.</li> <li>Lead a guided discussion on Eigen values and vectors, illustrating the methods applied in solving their problems.</li> </ul>

### Assessment Strategies

The learner:

- does assignment on matrix algebra and linear systems of equations.
- does classwork on transpose of matrix.



## Resources

- Scientific calculator
- Graph papers
- *Backhouse II*

## Sub-module 7: Trigonometry

Duration: 16 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• applies Pythagoras theorem of triangles in determining roof pitch angles.</li> <li>• applies Pythagoras theorem in determining the areas of land and floors .</li> <li>• draws trigonometric graphs.</li> <li>• solves trigonometric equations.</li> </ul>	<ul style="list-style-type: none"> <li>• The general angle</li> <li>• Pythagoras theorem</li> <li>• Graphs of Trigonometrical functions</li> <li>• Trigonometrical ratios of <math>30^\circ</math>, <math>45^\circ</math>, <math>60^\circ</math></li> <li>• Compound angles</li> <li>• Maxima and Minima values</li> <li>• Sine, cosine, tangent and half angle formulae</li> <li>• Height and distances</li> </ul>	<ul style="list-style-type: none"> <li>• Display derivation of 3:4:5 method using flash cards on boards.</li> <li>• Guide the learner to set out right angle on a play field using strings.</li> <li>• Demonstrate how to draw trigonometrical graphs.</li> <li>• Guide the learner to solve trigonometric equations using sine, cosine, tangent and half angle formulae.</li> </ul>

## Assessment Strategies

The learner does class work on calculation of trigonometric ratios.

## TDIT 117: Computer Applications

Duration: 60 Hours

### Module Overview

This module equips the learner with the data presentation skills using a computer, computer application packages and the Internet.

### Learning Outcomes

By the end of the module, the learner should be able to use the computer to present data, typeset and search for information on Internet

### Preparatory Assignment

Before teaching this module, ask the learner to write a simple report of one page in class on chosen topics, it is to be collected and assumed misplaced and they are asked to have it written again. Task the learner to compare the first and second reports.

### Result

The learner compares the previous and current reports, evaluates the duration spent, discusses it and presents it in the class. Also compares hand and computer written work and their storage.

## Sub-module 1: Introduction

Durations: 6 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>differentiates hardware components, and software, devices and types of computers.</li> <li>uses computer devices to store and produce reports.</li> </ul>	<ul style="list-style-type: none"> <li>Introduction to Information Technology, history of computing devices.</li> <li>Hardware and software components, devices and types. Basic computer architecture and organisation.</li> <li>Data representation in a computer.</li> </ul>	<ul style="list-style-type: none"> <li>Display the phones, laptops, desktops, mice, flash discs etc and ask the group computer accessories from non-computer accessories.</li> <li>Lead a guided discussion on the introduction to Information Technology, history of computing devices.</li> <li>Illustrate on board the hardware and software components, devices</li> </ul>

Competences	Content	Teaching Strategies
<ul style="list-style-type: none"> <li>describes the types of operating systems, and file management.</li> </ul>	<ul style="list-style-type: none"> <li>Introduction to operating systems, file management</li> </ul>	<ul style="list-style-type: none"> <li>and types of computers.</li> <li>Guide the learner on the operating systems, file management, data storage and back-up.</li> </ul>

### Assessment Strategy

The learner practically manages files and data storage by using a computer.

### Resources

- Computer
- Projector
- Office software 2007/2010
- Mice
- Flash disc
- Monitor
- Laptop
- Desktop
- Tower
- Phones
- Hard discs
- CDs
- DVDs
- Extension cables
- External speakers

## Sub-module 2: MS Word

Durations: 16 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>initialises Microsoft Word using either the start button or a user created shortcut.</li> <li>creates a new document with desired word features included.</li> </ul>	<ul style="list-style-type: none"> <li>File Management:             <ul style="list-style-type: none"> <li>- opening a file</li> <li>- creating a folder</li> <li>- saving a document</li> <li>- saving a file on a computer, on a flash disk, on a compact disc (CD)</li> <li>- accessing a file through explore, my computer, backing up files,</li> <li>- scanning for virus</li> <li>- other safety measures</li> </ul> </li> <li>Adjusting a page layout:</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on the process of creating, opening, formatting, and saving a document/file.</li> <li>Demonstrate the techniques applied in saving and</li> </ul>

Competences	Content	Teaching Strategies
<ul style="list-style-type: none"> <li>• saves, creates word document to a desired user location.</li> <li>• adjusts page layout and orientation.</li> <li>• arranges data in one, two or three columns, makes page breaks, section breaks, indents and line spacing.</li> <li>• inserts information or picture in a document: cover page, blank page, drawing, table.</li> <li>• selects, copies, cuts, pastes, prints, type letter, changes font type and size, and aligns document.</li> <li>• uses MS word to draw, create shapes and tables.</li> <li>• writes letters and sends to specific groups.</li> <li>• Checks and</li> </ul>	<ul style="list-style-type: none"> <li>- orientation of pages</li> <li>- portrait</li> <li>- landscape</li> <li>- margins</li> <li>- size of pages</li> <li>- letter, A4, A3 Envelope, etc</li> <li>- arrangement of data in one, two, three columns</li> <li>- page breaks</li> <li>- section breaks</li> <li>- indents</li> <li>- line spacing</li> <li>- marking documents</li> <li>• Inserting Information in a document:               <ul style="list-style-type: none"> <li>- cover page</li> <li>- blank page</li> <li>- page breaks</li> <li>- Tables</li> <li>- spreadsheets</li> <li>- picture</li> <li>- clip art</li> <li>- Microsoft equation</li> <li>- symbol</li> <li>- page numbers</li> <li>- header</li> <li>- footer</li> <li>- cross reference</li> </ul> </li> <li>• Drawing; lines, text boxes, shapes, arches, curves, tables; grouping, rotating a drawing, use of grids</li> <li>• Writing mail:               <ul style="list-style-type: none"> <li>- Letters and letter wizard</li> <li>- e-mail messages</li> <li>- Creating envelopes and labels</li> <li>- Directory</li> <li>- Mail merge</li> </ul> </li> <li>• Checking and reviewing a document:               <ul style="list-style-type: none"> <li>- spelling and grammar</li> <li>- Thesaurus</li> </ul> </li> </ul>	<p>creating Word document to a desired user location.</p> <ul style="list-style-type: none"> <li>• Practically demonstrate the techniques of adjusting the page layout, formats and orientation of pages.</li> <li>• Display, hide non-printing formatting marks like: spaces, paragraph marks, manual line break marks, tab characters and emphasise where such can be located whenever required.</li> <li>• Guide the learner on checking and reviewing a document, opening a document and mail merging a document.</li> <li>• Practically demonstrate the techniques applied in changing text</li> </ul>

Competences	Content	Teaching Strategies
reviews and edits documents . • Uses Microsoft word tools to process and store data when preparing project reports.	<ul style="list-style-type: none"> <li>- Translation</li> <li>- word count</li> <li>- track changes</li> <li>- compare</li> <li>- protect a document</li> <li>• Tools:               <ul style="list-style-type: none"> <li>- searching for a file, word in a file,</li> <li>- replacing a word</li> <li>- ruler</li> <li>- gridlines</li> <li>- zoom</li> <li>- preview</li> <li>- document map</li> <li>- select</li> <li>- copy</li> <li>- paste</li> <li>- print</li> <li>- letter type</li> <li>- font</li> <li>- underline</li> <li>- bold</li> <li>- italics</li> <li>- align text: right, left, centre</li> <li>- justify</li> <li>- use of bullet points, numbers</li> </ul> </li> </ul>	format: font sizes and font types.

### Assessment Strategies

The Learner:

- type-sets his/her professional resume.
- does classwork on previewing, zooming and editing of document.

### Resources

- |                             |                     |
|-----------------------------|---------------------|
| • Computer                  | • Phones            |
| • Projector                 | • Hard discs        |
| • Office software 2007/2010 | • Mice              |
| • Flash disc                | • CDs               |
| • Monitor                   | • DVDs              |
| • Laptop                    | • Extension cables  |
| • Desktop                   | • External speakers |
|                             | • Tower             |

## Sub-module 3: MS Power Point

Durations: 8 Hours

Competences	Content	Teaching Strategies
<p>The Learner:</p> <ul style="list-style-type: none"> <li>• presents projects and other reports using MS Power point.</li> <li>• formats slide shows, timing, animations using slide master, handout master, notes master.</li> <li>• creates and saves slides and presents.</li> </ul>	<ul style="list-style-type: none"> <li>• Presentations views:           <ul style="list-style-type: none"> <li>- Normal</li> <li>- slide sorter</li> <li>- notes</li> <li>- page</li> <li>- slide show</li> <li>- timing</li> <li>- animations</li> <li>- using slide master</li> <li>- handout master</li> <li>- notes master</li> </ul> </li> <li>• Making a slide:           <ul style="list-style-type: none"> <li>- types of slide layout and background</li> <li>- using ruler</li> <li>- gridlines</li> <li>- zoom</li> <li>- dimensioning</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate how to start, save and close Ms Power Point documents.</li> <li>• Practically guide the learner on the creation, timing, animations, using slide master and handout master.</li> <li>• Lead a guided discussion on how to create slide shows.</li> </ul>

### Assessment Strategy

The learner:

- creates new views and makes presentations.
- does assignment on creation of slides.

### Resources

- Computer
- projector hard discs
- CDs
- DVDs
- Extension cables

## Sub-module 4: MS Excel

Durations: 12 Hours

Competences	Content	Teaching Strategies:
<p>The learner:</p> <ul style="list-style-type: none"> <li>• opens and closes a spreadsheet application.</li> <li>• imports and exports data from or to MS Access, web, text.</li> <li>• sorts and filters data.</li> <li>• groups data.</li> <li>• makes charts, graphs.</li> <li>• illustrates:               <ul style="list-style-type: none"> <li>- columns</li> <li>- line graphs</li> <li>- scatter</li> <li>- bar charts</li> <li>- pie charts and</li> <li>- donut</li> </ul> </li> <li>• inserts text, header, footer, word art, signature line numbers, and date, in a cell.</li> <li>• evaluates problems</li> </ul>	<p>Spreadsheet file management</p> <ul style="list-style-type: none"> <li>- creating sheets</li> <li>- formatting cells</li> <li>• Data management:               <ul style="list-style-type: none"> <li>- external data from Ms Access, web, text</li> <li>- sort and filter data</li> <li>- grouping data</li> </ul> </li> <li>• Data tools:               <ul style="list-style-type: none"> <li>- validation</li> <li>- consolidation</li> <li>- what if analysis?</li> <li>- remove duplication?</li> </ul> </li> <li>• Charts, graphs and illustrations:               <ul style="list-style-type: none"> <li>- column</li> <li>- line graphs</li> <li>- scatter</li> <li>- bar charts</li> <li>- pie charts</li> <li>- donut</li> </ul> </li> <li>• Inserting text:               <ul style="list-style-type: none"> <li>- header</li> <li>- footer</li> <li>- word art</li> <li>- signature line</li> <li>- tables</li> <li>- picture</li> <li>- clip art</li> <li>- shapes</li> <li>- tables</li> </ul> </li> <li>• Use of formula:               <ul style="list-style-type: none"> <li>- financial</li> <li>- logical</li> <li>- mathematical</li> <li>- trigonometrically</li> <li>- statistical</li> <li>- engineering</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate the process of managing, creating, opening and saving files.</li> <li>• Demonstrate creating a new spreadsheet based on default template.</li> <li>• Illustrate formatting sheets, cells, data entry techniques, and formulae application.</li> <li>• Guide the learner on inserting text, header, footer, word art, signature line numbers, and date, in a cell.</li> <li>• Demonstrate the use of formulae using cell references and arithmetic</li> </ul>

Competences	Content	Teaching Strategies:
using MS Excel formula.	- cube	operators (addition, subtraction, multiplication, division).

### Assessment Strategies

The Learner:

- makes bar charts, graphs and line graphs.
- does classwork on creating and applying simple formulae.

### Resources

- Computer
- projector Hard discs
- CDs
- DVDs
- Extension cables

## Sub-module 5: MS Access

Durations: 6 Hours

Competences	Content	Teaching Strategies
The learner creates and stores information in the database.	<ul style="list-style-type: none"> <li>• Use of Access database tools</li> <li>• Designing objects in Access, tables, forms, and queries</li> <li>• Designing databases in Access</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on use of access.</li> <li>• Guide the learner on how to design a database with access.</li> <li>• Demonstrate how to enter data in the tables.</li> </ul>

### Assessment Strategy

The learner designs databases and enters data with access.

### Resources

- Computer
- Projector



## Sub-module 6: Internet

Durations: 10 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>uses the Internet resources and opens web pages to get information.</li> <li>attaches files to outgoing emails.</li> <li>reads and downloads emails and attachment.</li> </ul>	<ul style="list-style-type: none"> <li>Introduction to the Internet and the world wide web, searching for information/surfing</li> <li>Electronic mail services:               <ul style="list-style-type: none"> <li>- composing</li> <li>- saving</li> <li>- sending and receiving mail</li> <li>- attaching files</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Demonstrate how to use the Internet resources and open websites to get information.</li> <li>Practically guide in composing of mails, attaching files to outgoing e-mail and sending e-mails.</li> <li>Lead a guided demonstration on how to open a sent e-mail, how to read and download information sent by e-mail.</li> </ul>

### Assessment Strategy

The learner practically uses Internet to submit his/her assignments.

### Resources

- Computer
- Projector
- Hard discs
- CDs
- DVDs
- Extension cables

## TDCH 111: Communication Skills

Duration: 60 Hours

### Module Overview

The module equips the learner with the writing and interpersonal skills of communication and develop positive attitudes in protecting and preserving the environment .

### Learning Outcome

By the end of this module, the learner should be able to communicate effectively to teammates and public.

### Preparatory Assignment

Make a statement to one learner outside the class while his/her friends are inside, and then get into the class, leaving the first learner outside. Send another learner outside such that the first learner communicates the original message to him/her and request him/her to repeat the same statement to the next and incoming member of the class. The first learner comes into the class leaving the second one outside and the process continues until the whole class is complete. Each learner on coming from outside shall write what he/she was told and thus communicates to his/her friend. These are to be compared with the first statement made.

### Result

The learner discusses the possible causes of divergences of the original message and suggests the possible remedies to errors in recording messages.

## Sub-module 1: Introduction to Communication Skills

Durations: 8 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>describes the communication process.</li> <li>identifies and explains forms of communication giving</li> </ul>	<ul style="list-style-type: none"> <li>Definitions of communication</li> <li>Objectives of communication</li> <li>The communication process</li> <li>Types of communication:               <ul style="list-style-type: none"> <li>- oral and written</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on objectives of communication and communication process.</li> <li>Group the</li> </ul>

Competences	Content	Teaching Strategies
advantages and disadvantages in each. <ul style="list-style-type: none"> <li>• identifies and minimises barriers to effective communication.</li> <li>• illustrates the communication flow in organisation.</li> </ul>	communication <ul style="list-style-type: none"> <li>- advantages and disadvantages of oral and written communication</li> <li>• Verbal and non-verbal communication</li> <li>• Forms of communication</li> <li>• Effective communication:               <ul style="list-style-type: none"> <li>- barriers to effective communication</li> <li>- how to achieve effective communication</li> <li>- consequences of not understanding or getting a different meaning</li> </ul> </li> <li>• Communication flows:               <ul style="list-style-type: none"> <li>- upward</li> <li>- downward</li> <li>- horizontal</li> </ul> </li> <li>• Organisational charts</li> </ul>	learners to discuss types of communication giving advantages and disadvantages of each. <ul style="list-style-type: none"> <li>• Illustrate on board the communication process, and emphasise on the possible entry points for barriers to effective communication.</li> <li>• Lead a guided discussion on how information flows (upward, downward and horizontal communication) in organisations.</li> </ul>

### Assessment Strategy

Task the learners in groups to make an organisational chart for the institution; and present to the class giving reasons as to why they think it is correct.

### Resources

- sample organisational chart
- Internet
- Newsletters
- Newspapers

## Sub-module 2: Writing Skills

Durations: 18 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>• makes and takes notes.</li> <li>• writes a technical report, an application letter and curriculum vitae.</li> <li>• presents a seminar or workshop paper.</li> <li>• writes business letters, memos and loose minutes.</li> </ul>	<ul style="list-style-type: none"> <li>• Note making:           <ul style="list-style-type: none"> <li>- importance of making notes</li> <li>- methods of making notes</li> <li>- how to make good notes</li> </ul> </li> <li>• Note-taking: importance of taking notes and how to take good notes</li> <li>• Technical report writing:           <ul style="list-style-type: none"> <li>- importance of reports</li> <li>- characteristics of a good report</li> <li>- elements of a report</li> </ul> </li> <li>• Application letter and curriculum vitae writing</li> <li>• Seminar and workshop paper presentation:           <ul style="list-style-type: none"> <li>- aspects to consider when preparing and delivering a paper and answer session in a seminar paper at a seminar or workshop</li> <li>- managing questions or workshop</li> </ul> </li> <li>• Writing business letters:           <ul style="list-style-type: none"> <li>- importance of business letters</li> <li>- principles of effective letter writing</li> <li>- elements of a business letter</li> </ul> </li> <li>• Memo writing and loose minutes</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on note-making and note-taking skills.</li> <li>• Demonstrate on board, the skills of writing a technical report, business letter, memo, loose minutes, application letters and personal CVs.</li> <li>• Lead a guided discussion on aspects to be considered when preparing and delivering or presenting a paper.</li> <li>• Group the learner to write business letters, memos and loose minutes.</li> </ul>

### Assessment Strategies

The learner:

- makes notes as the teacher shares the discussion with the class.
- takes homework on writing application letter and his/her personal CV, business letter, memo, and loose minutes.

## Resources

- Newspaper
- Oxford English Dictionary
- Old loose minutes
- Old memos
- Circulars
- Old application letters
- Old minutes
- Old CV

## Sub- module 3: Oral Communication Skills

Durations: 12 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>• applies listening skills in running out day-to-day activities.</li> <li>• prepares questions for oral interviews.</li> <li>• prepares and presents a speech.</li> <li>• organises and conducts a meeting.</li> <li>• conducts an interview.</li> <li>• does interviews.</li> </ul>	<ul style="list-style-type: none"> <li>• Listening:               <ul style="list-style-type: none"> <li>- importance of listening</li> <li>- stages of listening</li> <li>- how to improve on the listening skills</li> </ul> </li> <li>• Speaking:               <ul style="list-style-type: none"> <li>- interpersonal and public speaking</li> <li>- characteristics of a good speech</li> <li>- profile of a good speaker</li> </ul> </li> <li>• Conducting meetings:               <ul style="list-style-type: none"> <li>- types of meetings</li> <li>- roles of the chairperson</li> <li>- secretary and members in a meeting</li> <li>- How to organise and conduct an effective meeting: agenda, terms used in meetings, and minutes</li> </ul> </li> <li>• Interviews:               <ul style="list-style-type: none"> <li>- types of interviews</li> <li>- preparing for an interview</li> <li>- handling questions in an interview</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Elaborate the importance of listening when the speaker is communicating, listening rules and the techniques applied to capture the speaker's message in brief.</li> <li>• Lead a guided discussion on the characteristics of a good speech and profile of a good speaker.</li> <li>• Organise the learner to conduct a role-play. Ask the learner to choose for himself/herself the chair, secretary or be a member. Guide on the agenda formulations and minute format.</li> <li>• Group the learner to discuss how to prepare for interviews, conduct him/herself in an</li> </ul>

Competences	Content	Teaching Strategies
	- organising an interview	interview and how to organise for an interview.

### Assessment Strategies

The learner:

- performs a role-play while acting as the chairperson, secretary or member in a meeting, and writes the minutes.
- participates in an interview where he/she acts as panellists while the rest of the learners act as interview candidates.
- listens to the recording of the interview being played and answers questions after .
- does assignment on a speech and presents in class.

### Resources

- Newspapers
- Oxford English Dictionary
- Old loose minutes
- Old memos
- Circulars
- Old application letters
- Old minutes

## Sub-module 4: Trade Specific Communication

Durations: 8 Hours

Competences	Content	Teaching Strategies
The learner communicates well to clients, supervisors and authorities.	<ul style="list-style-type: none"> <li>• Communication between contractor and client procedures and precautions</li> <li>• Communication between client and consultants</li> <li>• Communication between contractor and consultants</li> <li>• Communication with local authorities</li> </ul>	<ul style="list-style-type: none"> <li>• Elaborate the importance of good approaches when communicating to supervisors, clients and general public.</li> <li>• Lead a guided discussion on the various formats used when communicating to supervisors, clients,</li> </ul>

	<ul style="list-style-type: none"> <li>• Communication during site inspections</li> <li>• How to deal with verbal instructions on site</li> </ul>	<p>team-mates and the general public.</p> <ul style="list-style-type: none"> <li>• Lead a guided tour of the industry for the learners to learn how to communicate between, client and contractor, client and consultant, communication with local authorities, foreman to the site engineer.</li> </ul>
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### Assessment Strategies

The learner:

- writes a requisition form requesting for material.
- prepares delivery note.

### Resources

- Oxford English Dictionary
- Copies organisational charts
- Internet
- Newsletters
- Newspapers
- Samples of loose minutes
- Copies of memos
- Circulars
- Sample application letters
- Sample minutes

## Sub-module 5: Social Affairs

Durations: 6 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>• describes gender inequalities between men and women.</li> <li>• analyses the</li> </ul>	<ul style="list-style-type: none"> <li>• Gender issues:             <ul style="list-style-type: none"> <li>- roles of men and women</li> <li>- education and gender</li> <li>- African Traditional</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on gender issues:             <ul style="list-style-type: none"> <li>- roles of men and women</li> <li>- education and</li> </ul> </li> </ul>

Competences	Content	Teaching Strategies
<p>population trends and factors responsible for population growth in Uganda.</p> <ul style="list-style-type: none"> <li>• observes and promotes human rights.</li> <li>• sensitises the community on environmental preservation.</li> <li>• demonstrates and protects environment.</li> </ul>	<p>society perception towards gender</p> <ul style="list-style-type: none"> <li>- influence of modernity towards gender</li> <li>- income inequalities between men and women</li> </ul> <ul style="list-style-type: none"> <li>• Population trends: <ul style="list-style-type: none"> <li>- factors responsible for population growth</li> <li>- advantages and disadvantages of a big population to economic development of a country</li> <li>- managing population growth</li> </ul> </li> <li>• Human rights: <ul style="list-style-type: none"> <li>- fundamental human rights</li> <li>- human rights at the workplace</li> <li>- roles of government in the promotion and protection of human rights</li> </ul> </li> <li>• Environmental preservation and protection</li> </ul>	<p>gender</p> <ul style="list-style-type: none"> <li>- African Traditional society perception towards gender</li> <li>- influence of modernity towards gender</li> <li>- income inequalities between men and women</li> </ul> <ul style="list-style-type: none"> <li>• Discuss population trends: <ul style="list-style-type: none"> <li>- factors responsible for population growth</li> <li>- advantages and disadvantages of a big population to the economic development of a country</li> <li>- managing population growth.</li> </ul> </li> <li>• Lead a guided discussion on human rights: <ul style="list-style-type: none"> <li>- fundamental human rights</li> <li>- human rights at the workplace</li> <li>- roles of government in the promotion and protection of human rights.</li> </ul> </li> <li>• Group the learner to discuss methods of preserving and protecting environment.</li> </ul>



## Assessment Strategy

The learner:

- describes group experience on the African traditional perception towards gender in Uganda, its population and managing population growth.
- does assignment on fundamental human rights and the role of government on promotion and protection of human rights.
- does class work on environmental preservation methods.

## Resources

- Display
- Charts
- Reports/Journals
- Media
- Uganda Constitution
- Documentaries

## Sub-module 6: Civic Education

Durations: 8 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• discusses features, advantages and disadvantages of democracy and decentralisation.</li> <li>• describes the functions of parliament, the judiciary, the cabinet and the doctrine of separation of powers.</li> <li>• describes the taxation system in Uganda, arms of government.</li> <li>• appreciates the</li> </ul>	<ul style="list-style-type: none"> <li>• Democracy:               <ul style="list-style-type: none"> <li>- features of democracy</li> <li>- advantages and disadvantages of democracy</li> </ul> </li> <li>• Decentralisation: strength and weaknesses of decentralisation</li> <li>• Arms of government:               <ul style="list-style-type: none"> <li>- functions of parliament</li> <li>- judiciary and the cabinet</li> <li>- the doctrine of separation of powers</li> </ul> </li> <li>• Taxation system:</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on civil education, democracy, and decentralisation.</li> <li>• Lead a guided tour of parliament for the learner to understand the functions of parliament.</li> <li>• Group the learner to brainstorm ideas on the need to comply on tax payments, legal policies regarding taxes and the relationship</li> </ul>

Competences	Content	Teaching Strategies
<p>need to pay relevant taxes.</p> <ul style="list-style-type: none"> <li>discusses various roles and challenges faced by trade unions.</li> </ul>	<ul style="list-style-type: none"> <li>roles of taxation</li> <li>principles of a good tax</li> <li>categories of taxes in Uganda</li> <li>direct and indirect taxes</li> <li>advantages and disadvantages of direct and indirect taxes</li> <li>Trade Unions: <ul style="list-style-type: none"> <li>roles of trade unions</li> <li>challenges faced by trade unions</li> </ul> </li> </ul>	<p>between tax body URA and PPDA.</p> <ul style="list-style-type: none"> <li>Outline the roles of trade unions and the challenges faced by trade unions.</li> </ul>

### Assessment Strategies

The learner:

- does class test on taxation, and why the need for taxes is important for government and public.
- does assignment on functions of parliament, judiciary and the cabinet.
- does homework on advantages and disadvantages of decentralisation.
- researches on features of democracy, its advantages and disadvantages.

### Resources

- Chalk/writing board
- Relevant textbooks
- Display charts
- Reports/Journals
- Media
- Documentary
- URA handbook and leaflets
- PPDA handbook
- Uganda constitution
- Financial regulations of an organisation

## TDME 114: Engineering Drawing

Duration: 60 Hours

### Module Overview

This module equips the learner with the drawing skills as a means of graphical communication for engineers and the materials used.

### Learning Outcome

By the end of this module, the learner should be able to use the drawing equipment and materials to graphically communicate the engineering language using lines and symbols

### Preparatory Assignment

Before teaching this module, organise and display some ceramic products and task the learners to sketch their pictorial outlook

### Result

The learner relates line sketches to actual items displayed, and writes the item specifications to present in groups to the class.

## Sub-module 1: Introduction to Drawing

Duration: 2 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>uses drawing equipment.</li> <li>applies printing styles and types of lines correctly.</li> <li>sketches and dimensions the drawings.</li> </ul>	<ul style="list-style-type: none"> <li>Use of drawing equipment:               <ul style="list-style-type: none"> <li>types and sizes of drawing papers and boards</li> <li>drawing paper layout</li> <li>types of title blocks and their applications</li> <li>types of lettering and printing methods</li> <li>Types of lines and their applications.</li> </ul> </li> <li>Drawing paper planning, notes, block plan, scale,</li> </ul>	<ul style="list-style-type: none"> <li>Display drawing equipment and task the learner to identify them.</li> <li>Demonstrate the use of the various equipment.</li> <li>Lead a guided discussion on drawing equipment, types and sizes of drawing papers, and paper layout.</li> <li>Demonstrate the types of and techniques of lettering and printing styles recommended for building plans.</li> </ul>

Competences	Content	Teaching Strategies
	<ul style="list-style-type: none"> <li>• Hand sketching</li> <li>• Dimensioning</li> </ul>	<ul style="list-style-type: none"> <li>• Guide the learner through hand sketching and dimensioning.</li> </ul>

### Assessment Strategy

The learner practically sets out the A4 plain drawing sheet and draws the types of lines used in drawing.

### Resources

- Drawing board
- Drawing paper
- T-square and drawing set
- Pencils
- Scale rule

## Sub-module 2: Simple Geometrical Constructions

Duration: 6 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• constructs perpendicular and parallel lines.</li> <li>• constructs angles and squares with the aid of compasses.</li> <li>• divides lines into given parts.</li> </ul>	<ul style="list-style-type: none"> <li>• Connecting-lines, perpendiculars and parallels</li> <li>• Construction angles and squares with compasses</li> <li>• Bisection and division of a line into equal parts</li> </ul>	<ul style="list-style-type: none"> <li>• Illustrate on board the construction of connecting lines, perpendicular and parallel lines.</li> <li>• Guide the learner through the construction of angles and squares with compasses, bisecting and dividing of a line into equal parts.</li> </ul>

### Assessment Strategies

The learner:

- constructs angles and squares with compasses.

- bisects and divides a line into equal parts.

### Resources

- Compass
- Dividers
- Papers
- Erasers
- Drawing boards
- Set squares
- Scale rule

## Sub-module 3: Principles of Tangency

Duration: 6 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>• constructs inscribing and circumscribing arcs on objects.</li> <li>• determines the centre of a circle touching the inner sides of a given polygon, circle touching the vertices of a given polygon.</li> </ul>	<ul style="list-style-type: none"> <li>• Construction of internal and external tangents to circles of both equal and unequal diameters:           <ul style="list-style-type: none"> <li>- internal and external curved tangents to both equal and unequal circles</li> <li>- construction of inscribing and circumscribing arcs</li> <li>- determining the centre of a circle touching the inner sides of a given polygon</li> <li>- circle touching the vertices of a given polygon</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Ask the learner to describe the construction of internal and external tangents to circles of both equal and unequal diameters.</li> <li>• Guide the learner through the techniques of inscribing and circumscribing arcs, determining the centre of circle touching the sides of a given polygon.</li> <li>• Illustrate the principles of constructing tangents to a circle from a point outside the circle.</li> </ul>

### Assessment Strategies

The learner:

- constructs internal and external tangents to circles of both equal and unequal diameters.

- does homework on determining the centre of a circle touching the inner sides of a given polygon and circle touching the vertices of a given polygon.

### Resources

- Compass
- Dividers
- Papers
- Erasers
- Drawing boards
- Set squares
- Scale rule

## Sub-module 4: Simple Plane Figures

Duration: 6 Hours

Competences	Content	Teaching Strategies
The learner constructs geometrical plane figures like; triangles, rectangles, quadrilaterals, trapezium, rhombus and various regular polygons.	<ul style="list-style-type: none"> <li>• Definitions of geometrical plane figures: triangles, rectangles, quadrilaterals, trapezium, rhombus and various regular polygons</li> <li>• A circle and its properties</li> </ul>	<ul style="list-style-type: none"> <li>• Guide learners through the description of a geometrical plane figure: <ul style="list-style-type: none"> <li>- triangles</li> <li>- rectangles</li> <li>- quadrilaterals</li> <li>- trapezium</li> <li>- rhombus and various regular polygons</li> <li>- a circle and its properties</li> </ul> </li> <li>• Demonstrate the construction of the geometrical plane figures: <ul style="list-style-type: none"> <li>- triangles</li> <li>- rectangles</li> <li>- quadrilaterals</li> <li>- trapezium</li> <li>- rhombus and various regular polygons at a given point on a line</li> </ul> </li> </ul>

### Assessment Strategy

The learner practically draws all the geometrical plane figures.

### Resources

- Compass

- Dividers
- Papers
- Erasers
- Drawing boards
- Set squares
- Scale rule

## Sub-module 5: Transformation of Plane Figures

Duration: 8 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• transforms given shapes/figures to required one.</li> <li>• reduces and enlarges in proportions a given figure in both radial and direct methods.</li> </ul>	<ul style="list-style-type: none"> <li>• Transforming given shapes/figures to the required one:               <ul style="list-style-type: none"> <li>- reducing a given shape to a required one</li> <li>- reduction and enlargement in proportions a given figure in both radial and direct methods.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Describe the transformation of given shapes/figures to the required one.</li> <li>• Demonstrate the techniques applied to reduce and enlarge proportions of given figures in both radial and direct methods.</li> </ul>

### Assessment Strategy

The learner does class work on transformation, reduction and enlargement of given shapes/figures to required one.

### Resources

- Compass
- Dividers
- Papers
- Erasers
- Drawing boards
- Set squares
- Scale rule

## Sub-module 6: Loci and Special Curves

Duration: 6 Hours

Competences	Content	Teaching Strategies
The learner constructs ellipses and special curves.	<ul style="list-style-type: none"> <li>Drawing of ellipses and special curves</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on methods and techniques of constructing an ellipse.</li> <li>Illustrate the practical applications of ellipses and special curves on tables, doors, arches and bridges.</li> </ul>

### Assessment Strategy

The learner does class work by drawing elliptical table-tops using the compass.

### Resources

- Compass
- Dividers
- Papers
- Erasers
- Drawing boards
- Set squares
- Scale rule

## Sub-module 7: Principles of Orthographic Projection

Duration: 8 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>draws objects in first and third angle projections.</li> <li>represents correctly and indicate the correct symbol for first and third angle projections.</li> <li>applies the given</li> </ul>	<ul style="list-style-type: none"> <li>Drawing paper planning:</li> <li>introduction to principles of first and third angle projection and applications three view drawing of regular solids in first and third angle projection of</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on the differences and similarities between first and third angle projections.</li> <li>Lead a guided discussion on the principles of first and third angle</li> </ul>



Competences	Content	Teaching Strategies
scale.  <ul style="list-style-type: none"> <li>• applies dimensioning-size, local and redundant dimensions.</li> </ul>	cubes and rectangular solids  <ul style="list-style-type: none"> <li>• conventions applied in dimensioning; selection of dimensions – size, local and redundant dimensions               <ul style="list-style-type: none"> <li>- thickness of extension and dimensional lines</li> <li>- fitting dimensions onto an orthographic drawing</li> </ul> </li> </ul>	projections. <ul style="list-style-type: none"> <li>• Illustrate how to draw first and third angle projections and give learners an assignment to practise.</li> <li>• Guide the learner to identify the appropriate symbols applied for each projection.</li> <li>• Illustrate thickness of extension and dimension lines, fitting dimensions onto an orthographic drawing.</li> </ul>

### Assessment Strategy

The learner does classwork on first and third angles projection.

### Resources

- Compass
- Dividers
- Papers
- Erasers
- Drawing boards
- Set squares

## Sub-module 8: First Auxiliary Projection

Duration: 4 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>draws viewing plane lines related to auxiliary views and auxiliary views as part of a working drawing.</li> <li>determines the true length of a line in space.</li> <li>projects first and second auxiliary views.</li> </ul>	<ul style="list-style-type: none"> <li>Definition and application of auxiliary projection</li> <li>Determination of true length of a line in space</li> <li>Determination of true shape of a plane in space</li> <li>1st auxiliary projection practice</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on the difference between auxiliary views and principal planes.</li> <li>Illustrate the principles and application of auxiliary projections.</li> <li>Demonstrate the selected object like a school seat bench, the first auxiliary plane and elevation from given views.</li> </ul>

### Assessment Strategy

The learner illustrates the principles of auxiliary projections by drawing.

### Resources

- Compass
- Dividers
- Papers
- Erasers
- Drawing boards
- Set squares
- Scale rule

## Sub-module 9: Sectional Views

Duration: 6 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>identifies the true shape of cut surfaces of various geometrical objects.</li> <li>hatches the true shape of a cut surface.</li> <li>applies the principles of sectioning to simplify drawing interpretation.</li> </ul>	<ul style="list-style-type: none"> <li>Definition and significance of sectioning: where and how to section and shade/hatch considering cutting plane; types of sections to include full/half sections, local/revolved sections, part/removed sections, off-set/aligned sections and section lines; dimensioning isometric drawing</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion with the use of models and charts to explain the concept and importance of sections.</li> <li>Describe the importance of drawing true shapes of cut surfaces of objects.</li> <li>Guide the learner to apply the principles of sections to construct true shapes of cut surfaces.</li> </ul>

### Assessment Strategy

The learner practically demonstrates the drawing and application of sectioning on a VIP concrete slab and hatches the drawn section.

### Resources

- Compass
- Dividers
- Papers
- Erasers
- Drawing boards
- Set squares
- Scale rule

## Sub-module 10: Isometric and Oblique Projection

Duration: 8 Hours

Competences	Content	Teaching Strategies
The learner draws objects in isometric and oblique projections.	<ul style="list-style-type: none"><li>Principles of isometric and oblique projection as applied to simple cubic objects</li></ul>	<ul style="list-style-type: none"><li>Lead a guided discussion on the principles for isometric, oblique and axonometric projection drawings.</li><li>Practically demonstrate how to apply the principles to draw a building block and a bench in oblique projection.</li></ul>

### Assessment Strategy

The learner does class work exercise on drawing a VIP slab in isometric, oblique and axonometric projections.

### Resources

- Compass
- Dividers
- Papers
- Erasers
- Drawing boards
- Set squares
- Scale rule

# TDCR 111: Ceramic Technology I

Duration: 60 Hours

## Module Overview

This module introduces the learner to the raw materials used in ceramics and their preparation.

## Learning Outcome

By the end of this module, the learner should be able to select and prepare the ceramic materials as required.

## Preparatory Assignment

Prior to teaching this module, take the learner to visit clay, kaolin, feldspar quarries, hardware shops and studios and ask him/her to observe the processes involved in preparing ceramic materials.

## Results

The learner observes the processes involved in preparing ceramic materials, discusses the findings, writes a report and makes group presentation in class.

## Sub-module 1: Introduction to Ceramic Raw Materials

Duration: 15 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>describes formation and clay classification.</li> <li>wins and prepares the clay.</li> <li>describes the physical properties of clay.</li> <li>uses ceramic tools and equipment.</li> <li>sketches ceramic tools.</li> </ul>	<ul style="list-style-type: none"> <li>Formation and classification, winning and preparation ; location, physical properties.</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on classification, types, winning, preparation and physical properties of clay.</li> <li>Demonstrate the processes of winning clay and clay body preparations.</li> <li>Illustrate the techniques applied in sketching the identified tools used in clay body preparations.</li> </ul>

**Assessment Strategies**

The learner:

- wins clay and clay body preparation.
- illustrates the tools and equipment using sketches.

**Resources**

- Drawing boards
- T-square
- Set square
- calculator
- French curves
- Hoes
- Forked hoes
- Clay samples

**Sub-module 2: Ceramic Products**

Duration: 10 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>• classifies ceramic products.</li> <li>• uses ceramic products.</li> <li>• develops new ceramic products.</li> </ul>	<ul style="list-style-type: none"> <li>• Classification and use of various ceramic products.</li> <li>• importance of the products and the latest development in the industry.</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on the importance and application of ceramic products.</li> <li>• Illustrate using sketches some of the common ceramic products in the market.</li> <li>• Group the learner to develop new ceramic products.</li> </ul>

**Assessment Strategy**

The learner illustrates using sketches the common ceramic products on the market.

**Resources**

- Ceramic raw materials
- Internet
- Documentary

## Sub-module 3: Winning

Duration: 15 Hours

Competences	Content	Teaching Strategies
The learner <ul style="list-style-type: none"> <li>locates various quarries in his/her locality.</li> <li>applies different methods during the winning of clay.</li> <li>uses tools and equipment for winning.</li> <li>prepares and stores clay.</li> </ul>	<ul style="list-style-type: none"> <li>Location of quarries</li> <li>Methods of winning</li> <li>Loading, transportation</li> <li>Tools and equipment</li> <li>Storage and preparation of the raw materials.</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on location of clay quarries.</li> <li>Take the learner to any clay quarry site to observe the nature of environment that clay can be found in.</li> <li>Lead a guided discussion on methods and procedures of winning clay.</li> <li>Demonstrate the methods of winning clay.</li> <li>Guide a discussion on loading and transportation of clay.</li> <li>Take a visit to the clay quarry and task the learner to find out methods of loading clay to be transported.</li> <li>Display and guide the learner on identification of tools and equipment for winning clay.</li> <li>Lead a discussion on transportation, storage and preparation of clay.</li> <li>Demonstrate storage of clay.</li> </ul>

### Assessment Strategies

The learner:

- makes a return demonstration on methods of winning clay.
- makes a report about the visit on the methods of loading and transporting clay.

### Resources

- Internet
- Documentary
- Assorted tools and equipment
- Notebook
- A pen / A pencil

- Assorted tools
- Clay body samples
- Sieves
- A damp room
- Polythene papers
- Wedging table

## Sub-module 4: Body Preparation

Duration: 20 Hours

Competences	Content	Teaching strategies
<p><b>The learner:</b></p> <ul style="list-style-type: none"> <li>• identifies and differentiates a single material body from a multiple material body.</li> <li>• prepares proportions, blends and stores clay bodies.</li> </ul>	<ul style="list-style-type: none"> <li>• Single material body</li> <li>• Multiple material body</li> <li>• Preparation, proportioning, blending and storage.</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on single material body.</li> <li>• Display material samples and ask the learner to identify those used in ceramic works.</li> <li>• Demonstrate preparation, proportioning, blending and storage of clay body.</li> <li>• Demonstrate a single material body.</li> </ul>

### Assessment Strategies

The learner:

- carries out materials proportioning , blending and storage of clay body.
- prepares the single material body.

### Resource

- Clay bodies



## NDCR 112: Ceramics Chemistry I

Duration: 60 Hours

### Module Overview

This module introduces the learner to the Chemistry of structure and properties of engineering materials.

### Learning Outcome

By the end of this module, the learner should be able to analyse the chemical and physical properties of materials and improve on their processing.

### Preparatory Assignment

Display various materials and task the learner to identify the physical and chemical properties.

### Results

The learner observes the materials and discusses their properties.

## Sub-Module 1: Introduction

Duration: 6 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>draws the atomic structure of different elements.</li> <li>represents the formation of molecules schematically.</li> <li>illustrates the chemical reaction, equation and stoichiometry formulae.</li> </ul>	<ul style="list-style-type: none"> <li>Elementary atomic structure, isotopes, nomenclature</li> <li>The mole concept, atomic and molar mass,</li> <li>Stoichiometry, formulae, equations;</li> <li>Oxidation numbers, oxidation state;</li> <li>Chemical reaction types;</li> <li>Limiting reactants and product yields; redox Chemistry.</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on elementary atomic structure, isotopes, nomenclature, the mole concept.</li> <li>Illustrate chemical reaction equation and stoichiometry formulae.</li> <li>Illustrate the atomic structure of different elements.</li> <li>Lead a guided discussion on chemical reaction types; limiting reactants and product yields; redox Chemistry.</li> </ul>

**Assessment Strategy**

The learner does class work on elementary atomic structure, isotopes, nomenclature, the mole concept.

**Resources**

- Flip charts
- Documentary
- Relevant textbooks

**Sub-module2: Structure and Bonding**

Duration: 12 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>• describes the electronic configuration, metallic, ionic and covalent bonding.</li> <li>• illustrates electronegativity, bond polarity, bond strength.</li> <li>• analyses electrovalent, covalent and coordinate bonds, H-bond in HF, water and ice.</li> <li>• classifies solids.</li> <li>• relates between structure and properties of crystalline solids.</li> <li>• describes the properties and uses of Carbon, Silicon and</li> </ul>	<ul style="list-style-type: none"> <li>• Electronic configuration, metallic, ionic and covalent bonding.</li> <li>• Electronegativity, bond polarity, bond strength.</li> <li>• Electrovalent, covalent and coordinate bonds, H-bond in HF, water and ice.</li> <li>• Classification of solids – crystalline and amorphous.</li> <li>• Relationship between structure and properties of the following crystalline solids <ul style="list-style-type: none"> <li>- ionic solid i.e. Sodium chloride</li> <li>- covalent solid i.e. diamond and graphite</li> <li>- molecular solids i.e. metallic bonds and related properties.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on electronic configuration, metallic, ionic and covalent bonding, electronegativity, bond polarity, bond strength.</li> <li>• Illustrate electrovalent, covalent and coordinate bonds, H-bond in HF, water and ice.</li> <li>• Illustrate classification of solids – crystalline and amorphous.</li> <li>• Demonstrate relationship between structure and properties of the following crystalline solids: <ul style="list-style-type: none"> <li>- ionic solid i.e. Sodium chloride</li> </ul> </li> </ul>

Competences	Content	Teaching Strategies
Germanium.	<ul style="list-style-type: none"> <li>Properties and uses of Carbon, Silicon and Germanium</li> </ul>	<ul style="list-style-type: none"> <li>covalent solid i.e. diamond and graphite</li> <li>molecular solids</li> </ul>

### Assessment Strategies

The learner:

- does classwork on electronic configuration, metallic, ionic and covalent bonding.
- does classwork on electro negativity, bond polarity, bond strength.
- does assignment on electrovalent, covalent and coordinate bonds, H-bond in HF, water and ice.; classification of solids – crystalline and amorphous.

### Resources

- Flip charts
- Documentary
- Relevant textbooks

## Sub-module3: States of Matter

Duration: 12 Hours

Competences	Content	Teaching Strategies
<p><b>The learner:</b></p> <ul style="list-style-type: none"> <li>describes and illustrates the four states of matter.</li> <li>describes the properties of liquids, melting and boiling points, solvent properties, water as a solvent .</li> <li>analyses the chemical-vapour deposition chemical aspects of ceramics and glasses, ionic salts, covalent networks and molecular solids.</li> </ul>	<ul style="list-style-type: none"> <li>Solids, liquids and gases</li> <li>Intermolecular forces</li> <li>Properties of liquids, melting and boiling points, solvent properties, water as a solvent</li> <li>Solubility of compounds in water and other solvents</li> <li>Solids; ionic salts, covalent networks and molecular solids</li> <li>Chemical aspects of ceramics and glasses</li> <li>Chemical-vapour deposition</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on solids, liquids and gases.</li> <li>intermolecular forces; properties of liquids, melting and boiling points, solvent properties, water as a solvent; solubility of compounds in water and other solvents.</li> <li>Lead a guided discussion on chemical-vapour deposition, chemical aspects of ceramics and glasses; ionic salts, covalent networks and molecular solids.</li> </ul>

### Assessment Strategy

The learner does class work on solids, liquids and gases; inter-molecular forces: properties of liquids, melting and boiling points, solvent properties, water as a solvent.

### Resources

- Flip charts
- Documentary
- Relevant textbooks

## Sub-module4: Colloidal State of Matter

Duration: 14 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>prepares colloidal solutions, dialysis and electro-dialysis.</li> <li>describes properties of colloidal solution.</li> <li>describes types of emulsion.</li> <li>applies colloids Chemistry in ceramic production industries.</li> </ul>	<ul style="list-style-type: none"> <li>Concept of colloidal and its types, different system of colloids, dispersed phase and dispersion medium</li> <li>Methods of preparation of colloidal solutions, dialysis and electro-dialysis</li> <li>Properties of colloidal solution with special reference to absorption, Brownian Movement, tyndal effect, Electro phoresis and coagulation, relative stability of hydrophilic and hydrophobia colloids</li> <li>Protection and protective colloids</li> <li>Emulsion, types, preparation, properties and uses</li> <li>Application of colloids Chemistry in different industries</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on concept of colloidal and its types, different system of colloids, dispersed phase and dispersion medium.</li> <li>Demonstrate methods of preparation of colloidal solutions, dialysis and electro-dialysis.</li> <li>Lead a guided group discussion on properties of colloidal solution with special reference to absorption, Brownian Movement, tyndal effect, electro-phoresis and coagulation, relative stability of hydrophilic and hydrophobia colloids; protection and protective colloids; emulsion; types, preparation, properties and uses.</li> <li>Lead a guided tour of ceramic production industry for the learner to observe application of colloids Chemistry in different industries.</li> </ul>

### Assessment Strategy

The learner does class work on concept of colloidal and its types, different system of colloids, dispersed phase and dispersion medium.

**Resources**

- Flip charts
- Documentary
- Relevant textbooks

## Sub-module 5: Chemical Equilibrium in Aqueous Solution

Duration: 6 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• applies Le Chatelier's principle in manufacture of ceramic products.</li> <li>• evaluates quantitative calculations.</li> <li>• describes the pH of strong acids and bases, pH of weak acids and bases.</li> </ul>	<ul style="list-style-type: none"> <li>• The equilibrium state, equilibrium constants, Le Chatelier's principle, quantitative calculations.</li> <li>• Acid-base equilibria,</li> <li>• pH of strong acids and bases,</li> <li>• pH of weak acids and bases;</li> <li>• Buffers.</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on the equilibrium state, equilibrium constants, Le Chatelier's Principle.</li> <li>• Illustrate quantitative calculations.</li> <li>• Group the learners to discuss:               <ul style="list-style-type: none"> <li>- acid-base equilibria</li> <li>- pH of strong acids and bases</li> <li>- pH of weak acids and bases</li> <li>- buffers</li> </ul> </li> </ul>

**Assessment Strategies**

The learner:

- does class work on quantitative calculations.
- does homework on pH of strong acids and bases, pH of weak acids and bases.

**Resources**

- Flip charts
- Documentary

## Sub-module 6: Organic Chemistry and Polymers

Duration: 6 Hours

Competences	Content	Teaching Strategies
<p><b>The learner:</b></p> <ul style="list-style-type: none"> <li>describes systematic Chemistry of carbon compounds</li> <li>Selects reactions to make familiar and commodity materials including polymers used in coatings, fibres and tyres.</li> </ul>	<ul style="list-style-type: none"> <li>The systematic Chemistry of carbon compounds.</li> <li>Nomenclature and properties of common organic functional groups.</li> <li>Oxidation, reduction, addition, substitution, elimination</li> <li>The application of selected reactions to make familiar and commodity materials including polymers used in coatings, fibres and tyres</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on the systematic Chemistry of carbon compounds, nomenclature and properties of common organic functional groups; oxidation, reduction, addition, substitution, elimination.</li> <li>Group the learner to selected reactions to make familiar and commodity materials.</li> </ul>

### Assessment Strategy

The learner does class work on properties of common organic functional groups: oxidation, reduction, addition, substitution and elimination.

### Resources

- Flip charts
- Documentary
- Relevant textbooks

## TDCR 113: Real Life Project

Duration: 60 Hours

### Module Overview

This module provides the learner the skills required to produce a ceramic articles from material identification, tools and equipment for winning, methods of winning, preparation of clay bodies, shaping methods and biscuit firing.

### Learning Outcome

By the end of this module, the learner should be able to carry out biscuit firing and produces a ceramic article.

### Preparatory Assignment

Before teaching this module, take the learner to the nearby clay quarry, pottery studios and clay ware industries to observe the processes involved in the manufacture of ceramic products.

### Results

The learner visits the site, observes the processes, discusses the processes with the quarry or industrial personnel, writes a report and makes a group presentation in class.

## Sub-module 1: Introduction to Ceramic Raw Materials

Duration: 10 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>locates and identifies raw-materials.</li> <li>transports and wins raw-materials.</li> <li>prepares and stores raw materials.</li> </ul>	<ul style="list-style-type: none"> <li>Location and identification, winning, loading, transportation, preparation including storage</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on ceramic raw materials.</li> <li>Demonstrate how to win raw materials.</li> <li>Demonstrate how to transport, prepare and store raw materials.</li> <li>Guide the learner through the practical preparation and storage of ceramic raw materials.</li> </ul>

### Assessment Strategy

The learner practically prepares and stores ceramic raw materials.



## Resources

- Clay body
- Models
- Different raw materials
- Protective gears
- Documentaries.

## Sub-module 2: Single Body Preparation

Duration: 20 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• sorts out the material and carries out preliminary crushing.</li> <li>• soaks the clay in troughs and feeds clay in blunger with the right amount of water.</li> <li>• removes slip and describes why.</li> <li>• pugs the plastic clay to remove the air pockets.</li> <li>• stores the clay for curing.</li> </ul>	<ul style="list-style-type: none"> <li>• Sorting of material.</li> <li>• Preliminary crushing</li> <li>• Soaking of clay in troughs</li> <li>• Feeding into blunger with sufficient water.</li> <li>• Removal of slip</li> <li>• Allow water to evaporate in open space.</li> <li>• Pug plastic clay</li> <li>• Store plastic clay for curing or ageing</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided tour of pottery workshop or ceramic factory for the learner to observe preparation of materials and the manufacturing processes.</li> <li>• Make a demonstration on single body preparation, the stages involved in the manufacture of ceramic products.</li> </ul>

## Assessment Strategies

The learner:

- visits the pottery studio, observes the processes, writes a report and presents it in groups in the class.
- practically prepares a single body to a required finish and texture.

## Resources

- Raw material
- Crushers, troughs, blunger, pug mill, and dump room.
- Computer

- Internet
- Chalkboard
- Charts.
- Documentary

### Sub- module 3: Elementary Shaping Methods

Duration: 20 Hours

Competences	Content	Teaching Strategies
The learner rolls clay into pieces of coils and forms simple shapes as cylinders, cups dries the formed shapes.	<ul style="list-style-type: none"> <li>• Hand forming: wedging and coiling; rolling clay into pieces of coils Forming simple shapes as cylinders, mugs, pots; cooking or plant pots, smoothening them and allowing to dry naturally on shelves</li> <li>• Slab making: wedge clay: cutting into reasonable pieces. Flattening pieces into slabs. Cutting and forming cylinders, bats, flower vases any other hallow objects and allowing them to dry naturally</li> </ul>	<ul style="list-style-type: none"> <li>• A guided tour of a pottery studio for the learners to identify various ceramic articles.</li> <li>• Display various ceramic articles in the workshop and ask the learner to suggest how they were shaped.</li> <li>• Demonstrate practically the shaping of various articles in the workshop.</li> <li>• Take the learner to visit a clay factory for him/her to observe the shaping techniques of various ceramic articles.</li> <li>• Demonstrate the making of slabs and flattening of pieces into slabs.</li> <li>• Illustrate the flattening of pieces into slabs.</li> <li>• Demonstrate the formation of cylinders and drying of formed shapes.</li> </ul>

#### Assessment Strategy

The learner practically shapes the ceramic products being manufactured.

#### Resources

- Clay body
- Shaping tools,
- Power point,
- Computer

- Models,
- Boards and drying wrack
- Chalk board,
- Internet,
- Textbooks,
- Charts
- sponge
- gum boots
- Overall
- Drawing instruments

## Sub-module 4: Biscuit Firing

Duration: 10 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• fettles the articles.</li> <li>• loads dry articles into the kiln.</li> <li>• fires the articles by setting the correct temperature.</li> <li>• allows the kiln to cool and offloads the articles.</li> </ul>	<ul style="list-style-type: none"> <li>• Cleaning or fettling using sand paper or knife and then a wet sponge.</li> <li>• Loading dry articles into a kiln</li> <li>• Firing to required temperature</li> <li>• Allowing articles to cool then offload</li> </ul>	<ul style="list-style-type: none"> <li>• Practically demonstrate the cleaning, loading, firing and offloading of ceramic articles.</li> <li>• Demonstrate practically, the fettling of the articles, the loading, setting the kiln temperature, firing.</li> <li>• Lead a guided tour of pottery studio for the learner to observe firing of ceramic articles.</li> <li>• Demonstrate offloading of articles.</li> </ul>

### Assessment Strategy

The learner practically cleans, loads, fires, cools and offloads the ceramic articles.

### Resources

- Dry samples
- Power point,
- Computer
- Internet,
- Charts
- Sponge
- Gum boots
- Overall
- Drawing instruments
- Kiln

# Detailed Modules Description of Year 1 Semester 2

## TDEM 121: Engineering Mathematics II

Duration: 60 Hours

### Module Overview

This module equips the learner with mathematical approaches of handling equations applied when determining structural deflections and their supports.

### Learning Outcome

By the end of the module, the learner should be able to apply calculus mathematical equations in determining structural beam deflections and curves.

### Preparatory Assignment

Take the learner to sites and finished buildings and ask him/her to critically analyse the bottom and top flatness of concrete or steel beams and slabs. Task the learner to discuss the possible causes of such deflections and what such deflections may lead to over duration.

### Result

The learner discusses the possible causes of beam and slab deflections and also suggests what could be done to limit this vice.

## Sub- module 1: Complex Numbers

Duration: 14Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>applies complex numbers to analyse the stresses of structures like buildings, dams and bridges.</li> <li>applies complex numbers in determining the flow of liquids in</li> </ul>	<ul style="list-style-type: none"> <li>Algebra of complex numbers</li> <li>The argand diagram</li> <li>Polar form of complex numbers</li> <li>Exponential form of a complex number</li> <li>Function of complex variable powers and roots</li> </ul>	<ul style="list-style-type: none"> <li>Illustrate the manipulation of equal complex numbers.</li> <li>Illustrate on board the methods applied in solving polar form of complex number.</li> </ul>

Competences	Content	Teaching Strategies
channels and tubes. <ul style="list-style-type: none"> <li>applies and uses Demouvers Theorem in the resolution of forces and phasors of electrical circuits.</li> </ul>	<ul style="list-style-type: none"> <li>De'mouvers theorem</li> </ul>	<ul style="list-style-type: none"> <li>Illustrate the techniques of plotting and drawing equal complex numbers on graphs.</li> </ul>

### Assessment Strategy

The learner does class exercises on:

- polar form and exponential form of complex numbers.
- group assignment on De'mouvers and Argant diagrams.

### Resources

- Engineering Mathematics Vol. 4 by A. K. Strouds
- Electronic calculators
- Drawing set
- Scientific calculator

## Sub-module 2: Hyperbolic Function

Duration: 10 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>applies hyperbolic identities in determining the inclination angles of retaining walls and buttress structures.</li> <li>evaluates problems having log form inverse.</li> <li>applies hyperbolic identities in determining the amount of light required to illuminate a surface.</li> </ul>	<ul style="list-style-type: none"> <li>Graphs of hyperbolic functions</li> <li>Evaluation of hyperbolic functions</li> <li>Inverse hyperbolic functions.</li> <li>Log form of inverse hyperbolic function</li> <li>Hyperbolic identities</li> <li>Trigonometric identities</li> <li>Relationship</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on hyperbolic identities, functions and graphs.</li> <li>Illustrate on board the manipulation of hyperbolic identities and functions.</li> <li>Illustrate the performance of hyperbolic function on the</li> </ul>

Competences	Content	Teaching Strategies
<ul style="list-style-type: none"> <li>applies hyperbolic identities in determining the amount of power flowing in electric power cables.</li> </ul>	between trigonometric and hyperbolic identities	formation of curves and hyperbolic graphs.

### Assessment Strategy

The learner:

- does class exercises on hyperbolic identities, function and graphs.
- does assignment on inverse hyperbolic functions and log form of inverse

### Resources

- Electronic calculators.
- Drawing set
- Scientific calculator

## Sub-module 3: Differential Calculus

Duration: 16 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>applies differential equations in determining the safety of beams and slabs against deflection.</li> <li>solves differential equations.</li> </ul>	<ul style="list-style-type: none"> <li>Differentiation of one and several variables</li> <li>The differentiability theorem</li> <li>Differentiation of different functions; Minima and Maxima</li> <li>Partial differentiation;</li> <li>The chain rule</li> </ul>	<ul style="list-style-type: none"> <li>Illustrate the manipulation of differential calculus from first principle and in the partial form, relating their application to beam deflection.</li> </ul>

### Assessment Strategy

The learner does assignment on differential function and application of the chain rule.

## Resource

Scientific calculator

## Sub-module 4: Integral Calculus

Duration: 10 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>evaluates integral equations.</li> <li>applies integral equations in solving engineering hydraulic problems.</li> </ul>	<ul style="list-style-type: none"> <li>Definite integrals</li> <li>Indefinite integrals</li> <li>Methods of integration</li> <li>Double and triple integrals.</li> <li>Application of integration</li> </ul>	<ul style="list-style-type: none"> <li>Illustrate on board the manipulation of definite, double and triple integral calculus and relating it to the application in solving hydraulics engineering problems.</li> <li>Illustrate on board the performance of Integral calculus in hydraulics.</li> </ul>

### Assessment Strategy

The learner does group assignment on definite integrals as well as double and triple integrals in relation to field application of hydraulics.

### Resources

- Scientific calculator
- Relevant Hydraulic textbooks

## Sub-module: 5 Ordinary Differential Equations

Durations: 10 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>• solves equations having first and second order, homogeneous equations.</li> <li>• applies second order equations with constant coefficients in determining varying loads of structures.</li> </ul>	<ul style="list-style-type: none"> <li>• Definition</li> <li>• Equation of first order differential and degree</li> <li>• Second order equations with constant coefficients</li> <li>• Homogeneous equations</li> <li>• Applications of differential equations</li> </ul>	<ul style="list-style-type: none"> <li>• Illustrate on board methods and techniques of manipulating ordinary differential equations and their application in engineering, including first and second order equations with constants.</li> <li>• Illustrate on board the performance and application of ordinary differential equations in solving hydrological problems.</li> </ul>

### Assessment Strategies

The learner:

- does class exercises on first and second order equations.
- does assignment on homogeneous equations.

### Resource

Scientific calculator



## TDCR 121: Ceramic Technology II

Duration: 60 Hours

### Module Overview

This module equips the learner with the skills of carrying out chemical and physical tests for materials, drying, dryers and their operation; glazes and their application; firing and kilns.

### Learning Outcome

By the end of this module, the learner should be able fire to the required temperature.

### Preparatory Assignment

Before teaching this module, take the learner to ceramic pilot plant at government Industrial Research Institute, Geological Surveys Department and the Central Materials Laboratory (Ministry of Works and Communications) or at Uganda national Bureau of Standards to carry out the testing of physical and chemical properties of fired ceramic products.

### Results

The learner visits the laboratory, observes the testing procedure, carries out the testing of the ceramic products, writes a report, discusses it in groups and makes presentations in class.

## Sub-module 1: Physical Tests and Chemical Tests

Duration: 10 Hours

Competences	Content	Teaching Strategies
<p><b>The learner:</b></p> <ul style="list-style-type: none"> <li>determines particle size distribution and plasticity indices of the material.</li> <li>determines the drying and firing shrinkage limits .</li> <li>sorts out</li> </ul>	<ul style="list-style-type: none"> <li>Physical Tests</li> <li>Sieve Analysis</li> <li>Plasticity</li> <li>Firing colour</li> <li>Drying and firing shrinkages</li> <li>Strength test: bending, tensile, compact</li> <li>Visual and texture inspection</li> <li>Chemical tests</li> <li>Carbonates, iron,</li> </ul>	<ul style="list-style-type: none"> <li>Take the learner to materials laboratory and carry out practical tests on material.</li> <li>Take various samples to the class and ask the learner to identify the materials by visual and texture inspection.</li> <li>Lead a guided discussion on the physical and chemical tests.</li> </ul>

Competences	Content	Teaching Strategies
carbonates, iron, phosphates, and soluble salts in the raw materials.	phosphates and water soluble salts	<ul style="list-style-type: none"> <li>Lead a guided discussion on chemical tests; identify carbonates, iron, phosphates, and soluble salts in the raw materials.</li> </ul>

### Assessment Strategy

The learner practically carries out Sieve Analysis, visual and texture inspection of the materials and products.

### Resources

- Flip charts
- Documentary
- Ball clay, kaolin, feldspar, sand
- Dilute cold hydrochloric acid, hot concentrated hydrochloric acid, oxidizing agents, hot caustic soda

## Sub-module 2: Drying and Dryer

Duration: 10 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• discusses importance of drying articles.</li> <li>• describes principles of drying.</li> <li>• uses various types of dryers in drying ceramic products.</li> </ul>	<ul style="list-style-type: none"> <li>• Importance of drying ceramic articles</li> <li>• Principles of drying</li> <li>• Dryers: types and operation</li> </ul>	<ul style="list-style-type: none"> <li>• Guide a discussion on the importance of drying ceramic articles.</li> <li>• Demonstrate the drying process and methods used.</li> <li>• Illustrate on board the principles observed on the drying of ceramic products.</li> <li>• Guide the learner through different types of dryers and their applications.</li> <li>• Demonstrate the operation and maintenance of dryers.</li> </ul>

## Assessment Strategies

The learner:

- practically dries the green ware and test.
- does assignment on principles of drying and dryers: types and operation.

## Resources

- Chalk board/writing board
- Flip charts
- Documentary
- On-line sources
- Green ware

## Sub- module 3: Firing and Kilns

Duration: 20 Hours

Competences	Content	Teaching Strategies
<p><b>The learner:</b></p> <ul style="list-style-type: none"> <li>• constructs kilns.</li> <li>• uses suitable fuels for firing in kilns.</li> <li>• controls the temperatures for biscuit, glost and decoration firings.</li> <li>• glazes and decorates the biscuit fired articles.</li> </ul>	<ul style="list-style-type: none"> <li>• Kilns</li> <li>• Classification, construction and operation</li> <li>• Fuels</li> <li>• Firing</li> <li>• Biscuit and glost firing</li> <li>• Decoration firing</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on kilns, classification of kilns and on identifying suitable kilns fuels.</li> <li>• Carry out demonstration on kiln operation.</li> <li>• Illustrate on board the temperature control methods for biscuit, glost and decoration firings.</li> <li>• Practically demonstrate glazing and decorating biscuit fired articles.</li> </ul>

**Assessment Strategies**

The learner:

- practically glazes and decorates biscuit fired articles.
- does assignment on classification, construction and operation of kilns.

**Resources**

- Documentary
- On-line sources
- Ceramic articles
- Kiln hearth

**Sub-module 4: Fundamentals of Glazes**

Duration: 20 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>• selects raw materials for glazing by colour and texture.</li> <li>• classifies and batches the glazes.</li> <li>• carries out preparation of glaze and applies it on to a ceramic ware.</li> </ul>	<ul style="list-style-type: none"> <li>• General consideration</li> <li>• Classification of glazes</li> <li>• Raw materials</li> <li>• Preparation and application to ware</li> <li>• Melting of glazes</li> </ul>	<ul style="list-style-type: none"> <li>• Guide a discussion on identification and classifications of glazes.</li> <li>• Practically demonstrate the batching and blending or mixing of glaze for ceramic items.</li> <li>• Practically demonstrate glaze preparation and application.</li> <li>• Guide the learner through the monitoring of the melting of glazes.</li> </ul>

**Assessment Strategies**

The learner:

- practically batches and blends the glaze.
- practically proportions and applies the glaze on the ceramic surfaces.

## Resources

- Chalk board/writing board
- Flip charts
- Relevant textbooks
- Documentary
- On-line sources
- Ceramic articles
- Test kiln
- Test kiln
- Raw material used in glazing
- Port mill

# TDCR 122: Materials Science 1

Duration: 45 Hours

## Module Overview

This module gives the learner knowledge about crystal systems, microstructure and dependence on various properties.

## Learning Outcome

By the end of this module the learner should be able to use materials for making articles on the basis of their properties.

## Preparation Assignment

Before teaching this module, take the learner to the cement industry and steel rolling mills, and task him/her to note and observe the processes.

## Results

The learner writes a report and makes group presentation in the class.

## Sub-module 1: Classification of Ceramic Materials

Duration: 4 Hours

Competences	Content	Teaching Strategies
<p><b>The learner:</b></p> <ul style="list-style-type: none"> <li>classifies ceramic materials.</li> <li>melts and cast metals to form the desired designed shape.</li> <li>cuts and fixes glass in construction</li> </ul>	<ul style="list-style-type: none"> <li>Polymers and plastics</li> <li>Metals</li> <li>Glass</li> <li>Vitreous ceramics</li> <li>High performance engineering</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on classification of materials, polymers and plastics.</li> <li>Guide the learner in the discussion on identification of metals by their properties.</li> <li>Display various glass types and ask the learner to identify the differences on texture, thickness and colour.</li> </ul>

Competences	Content	Teaching Strategies
industry. <ul style="list-style-type: none"> <li>describes the importance and use of rubber.</li> <li>differentiates different materials of ceramics composites.</li> </ul>	ceramics <ul style="list-style-type: none"> <li>Rubbers</li> <li>Ceramic composites</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on importance of glass and its application..</li> <li>Lead a guided discussion on vitreous ceramics and their applications in domestic and industrial settings.</li> <li>Lead a guided discussion on classification of high performance engineering ceramics.</li> <li>Lead a guided discussion on the importance and application of rubber.</li> </ul>

### Assessment Strategies

The learner:

- identifies the glass by colour, texture and thickness and describes their applications.
- does exercise on ceramic composites.

### Resources

- Documentaries
- Internet

## Sub-module 2: Plastics

Duration: 6 Hours

Competences	Content	Teaching Strategies
<b>The learner:</b> <ul style="list-style-type: none"> <li>classifies plastics.</li> <li>describes the</li> </ul>	<ul style="list-style-type: none"> <li>Classification and types of plastics: thermoplastics and thermosetting</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on plastics, types of plastics and application.</li> <li>Illustrate on board the</li> </ul>

Competences	Content	Teaching Strategies
<ul style="list-style-type: none"> <li>composition and properties of plastics.</li> <li>• describes extrusion, injection, moulding and casting methods of manufacturing plastics.</li> <li>• uses the plastics for making articles.</li> </ul>	<p>plastics</p> <ul style="list-style-type: none"> <li>• Composition of plastics: plastic fillers and pigments</li> <li>• Properties of plastics: density, strength, thermal movements, durability, heat and sunlight resistance</li> <li>• Manufacture of plastics: extrusion, injection, moulding and casting</li> <li>• Uses of plastics in the building industry: tiles, films, sheets, pipes, tanks, sanitary appliances</li> </ul>	<p>composition of plastics, plastic fillers and pigment or use a documentary where applicable.</p> <ul style="list-style-type: none"> <li>• Illustrate on board, the properties of plastics, giving examples in reference to application.</li> <li>• Lead a guided discussion and illustrate the manufacture process of plastics on display charts, giving examples like moulding and casting.</li> <li>• Lead a guided discussion on the domestic and industrial uses of plastics.</li> </ul>

### Assessment Strategies

The learner:

- does assignment on manufacture process of plastics, moulding and casting.
- does class work on classification and properties of ceramics.

### Resources

- Display charts
- Documentary
- Internet



## Sub-module 3: Metals (Ferrous and Non-Ferrous Metals)

Duration: 10 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>describes types of ferrous metals.</li> <li>discusses properties of ferrous metals.</li> <li>extracts iron from its ores.</li> <li>describes the manufacturing process of steel items.</li> <li>carries standard tests for steel.</li> <li>limits corrosion and methods of preventing it.</li> <li>protects structures against fire.</li> <li>describes types of non-ferrous metals.</li> <li>extracts iron from its ores.</li> <li>describes the manufacturing process of steel items.</li> <li>carries standard tests for steel.</li> <li>protects steel structures</li> </ul>	<ul style="list-style-type: none"> <li>Ferrous metals</li> <li>Types of ferrous metals: pig iron, cast iron, wrought iron, mild steel, high tensile steel and stainless steel.</li> <li>Common alloys, alloying agents and importance of carbon in steel.</li> <li>Properties of ferrous metals: strength, thermal movements, appearance and density</li> <li>Extraction of iron from ores.</li> <li>Manufacturing process of steel items. Heat treatment, reasons for heat treatment, casting, rolling, hot and cold rolling, drawing and extruding.</li> <li>Common steel items used in buildings, steel sections, sheets / plates and bars.</li> <li>Standard tests for steel: tensile strength, creep, thermal strength and corrosion resistance</li> <li>Corrosion: causes</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on ferrous and non-ferrous metals.</li> <li>Display various metals and ask the learner to identify corroded ones and he/she suggests methods of protection, and differentiates between the two.</li> <li>Take the learner to steel rolling mills and ask them to observe the processes of manufacturing metals.</li> <li>Demonstrate how to protect ferrous metals against corrosion and fire by painting and providing concrete cover.</li> <li>Demonstrate standard tests for ferrous metals.</li> <li>Lead a guided discussion on non-ferrous metals.</li> <li>Demonstrate how to protect non-ferrous metals</li> </ul>

Competences	Content	Teaching Strategies
against rusting.	and methods of protection <ul style="list-style-type: none"> <li>• Effects of fire and fire protection.</li> <li>• Non-ferrous metals</li> <li>• Types of non-ferrous metals used in the building industry: copper, zinc, aluminium, lead, brass and bronze</li> <li>• Properties of common non-ferrous metals</li> <li>• Extraction from ores</li> <li>• Manufacturing process</li> <li>• Common items and their uses.</li> <li>• Standard tests</li> <li>• Corrosion and protection</li> </ul>	against corrosion. <ul style="list-style-type: none"> <li>• Discuss the manufacturing process of non-ferrous metals.</li> <li>• Group the learner to discuss extraction from ores.</li> <li>• Demonstrate standard tests for non-ferrous metals on chalk/writing board.</li> <li>• Demonstrate standard tests for non-ferrous metals.</li> <li>• Demonstrate how to protect ferrous metals against corrosion and fire by painting and providing concrete cover.</li> </ul>

### Assessment Strategies

The learner:

- protects metals by coating their surfaces with paints and covering with concrete.
- does assignment on manufacture and extraction of ferrous and non-ferrous metals.
- does homework on properties and types of ferrous and non-ferrous metals.

### Resources

- Display charts
- Documentary
- Internet
- Paints
- Concrete
- Steel bars
- Binding wire
- Iron sheets

## Sub-module 4: Concrete Products

Duration: 2 Hours

Competences	Content	Teaching Strategies
The learner produces blocks, bricks, pipes, roofing tiles and paving block.	<ul style="list-style-type: none"> <li>• Blocks</li> <li>• Bricks</li> <li>• Pipes</li> <li>• Roofing tiles</li> <li>• Paving blocks</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on concrete products, their manufacture, and application.</li> <li>• Demonstrate the production process of blocks, bricks, pipes, roofing tiles and paving blocks.</li> <li>• Display an assortment of concrete products and ask the learner to describe their application and advantages over other materials.</li> </ul>

### Assessment Strategy

The learner makes a pavers, slabs and blocks.

### Resources

- Assortment of concrete products
- Documentary
- Internet

## Sub-module 5: Mortars

Duration: 4 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• describes types of mortar and their properties.</li> <li>• batches, mixes and tests mortars for workability and water retention properties.</li> </ul>	<ul style="list-style-type: none"> <li>• Composition and types of mortars</li> <li>• Properties of mortars, workability and water retention</li> <li>• Production of mortars, mortar plasticizers</li> <li>• Use of different types of mortars</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on mortars, their composition, types and mixing ratios.</li> <li>• Illustrate the composition and types of mortars.</li> <li>• Demonstrate the batching, dry and wet mixing of mortar and testing of workability by slump and water retention properties.</li> <li>• Demonstrate the use of mortar types and their application on surfaces, and the curing.</li> </ul>

**Assessment Strategies**

The learner:

- batches, dries and wet-mixes the mortar to the desired workability and test for workability by slump.
- applies mortar on surfaces and finish surfaces as desired and cures the surfaces.

**Resources**

- An empty bucket of nomi/cylinder
- Sufficient amount of water
- A straight edge/ ruler
- Binder
- Fine aggregates
- Documentary
- Internet

**Sub-module 6: Lime**

Duration: 3 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>• describes types of lime.</li> <li>• carries tests on lime.</li> <li>• classifies lime and identifies sources.</li> <li>• describes manufacture and properties of lime.</li> <li>• slakes lime for use and applies it on surfaces.</li> </ul>	<ul style="list-style-type: none"> <li>• Types of lime</li> <li>• Tests of lime</li> <li>• Sources and uses of lime</li> <li>• Classification</li> <li>• Properties and manufacture</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on lime, types, mixing ratios and applications.</li> <li>• Demonstrate mixing, slaking of lime and tests for lime.</li> <li>• Guide the discussion on uses of lime like soil stabilisation.</li> <li>• Group discussion on classification, properties and sources of lime.</li> <li>• Discuss manufacture of lime, illustrating the line diagram for lime manufacture.</li> </ul>

**Assessment Strategies**

The learner:

- practically slakes the lime for mortar.

- stabilises murrum by mixing it with some lime and water.
- illustrates the lime manufacturing process by sketching.

### Resources

- Documentary
- Display charts
- Internet

## Sub-module 7: Cement

Duration: 6 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• describes the Chemistry hydration, setting of Portland cement.</li> <li>• discusses types and properties of Portland cement.</li> <li>• describes manufacture of cement.</li> <li>• carries tests on cement.</li> </ul>	<ul style="list-style-type: none"> <li>• The Chemistry: hydration, setting and hardening</li> <li>• Types and properties of Portland cement</li> <li>• Manufacture: wet and dry process</li> <li>• Composition and functions</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on cement: hydration, setting and hardening, emphasising the time each takes to gain maximum strength.</li> <li>• Lead a discussion on properties and types of cement and its binding power and demonstrate the test for cement soundness using a clear glass plate.</li> <li>• Lead a discussion on the manufacture of cement and illustrate by a line diagram.</li> <li>• Lead a discussion on the composition and function of cement.</li> <li>• Lead a discussion the chief ingredients of cement and their relative percentage in the composition.</li> </ul>

**Assessment Strategies**

The learner:

- practically tests cement for soundness.
- illustrates with the line diagram the manufacture of cement.
- does homework on types and properties of Portland cement.

**Resources**

- Documentary
- Internet
- Glass plate
- Cement sample
- Stirring stick
- Clean water

**Sub-module 8: Ceramics**

Duration: 8 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>• identifies and uses vitreous ceramic composites.</li> <li>• safeguards the environment using ceramic products.</li> </ul>	<ul style="list-style-type: none"> <li>• Vitreous ceramics composites</li> <li>• Processing of materials</li> <li>• Environmental effects (of processing)</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on ceramic composites and processing of materials and its environmental effects.</li> <li>• Guide the learner on the application of vitreous ceramics.</li> <li>• Use a documentary to show the processing of materials for vitreous ceramics.</li> <li>• Group the learner to discuss environmental protection.</li> </ul>

**Assessment Strategies**

The learner:

- participates in the discussion.
- finds solutions to the assignment on environmental effects of processing vitreous ceramics.
- writes a report on processing of materials for vitreous ceramics.

## **Resources**

- Documentary
- Fired articles
- Internet
- Ceramic water closets
- Ceramic sinks
- Ceramic cisterns

## TDCR 123: Environmental Science and Safety

Duration: 45 Hours

### Module Overview

This module equips the learner with the skills of protecting and conserving environment in ceramic engineering industry.

### Learning Outcome

By the end of this module, the learner should be able to protect, conserve and preserve the environment for the future.

### Preparatory Assignment

Take the learner to industries which produce considerable amount of chemical waste and ask the learner to access methods of protecting the environment and managing such waste.

### Results

The learner visits the industry, carries out the assessment, discusses the findings, writes a report and makes group presentations in class.

## Sub-module 1: Pollution Science

Duration: 9 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>assesses the extent of pollution in an environment.</li> <li>applies pollution preventive measures.</li> <li>sensitises the public on the environmental protection and its advantages.</li> </ul>	<ul style="list-style-type: none"> <li>Measurement of pollution.</li> <li>Chemical pollutants of national and global importance</li> <li>Chemistry of pollutants</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on pollution, forms of pollution, effects of pollution and the possible measures to lower it.</li> <li>Demonstrate pollution preventive measures like collecting litter.</li> <li>Lead a guided tour of a factory or industry that produces pollutants and ask the learner to assess the possibilities of reducing its effects on the public.</li> </ul>

### Assessment Strategies

The learner:

- practically collects litter at school and the nearby communities.



- carries out sensitisation of public on the reasons for protecting environment, emphasising this as our general responsibility.

### Resources

- Protective wares
- Boots and gloves
- Chalkboard
- Textbooks
- Internet
- Power point
- Charts
- Documentaries
- Notebooks and pens

## Sub-module 2: Environment Toxicology and Pollution

Duration: 12 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• demonstrates the methods of waste disposal.</li> <li>• designs appropriate waste treatment systems.</li> <li>• controls noise and dust pollution by planting trees.</li> </ul>	<ul style="list-style-type: none"> <li>• Waste disposal</li> <li>• Waste treatment</li> <li>• Noise and dust pollution</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided tour of an industry for the learners to observe how different wastes are treated and disposed.</li> <li>• Lead a guided discussion on various ways of waste treatment and disposal.</li> <li>• Demonstrate the ways of treating waste and separating waste.</li> <li>• Group the learner to discuss noise and dust pollution.</li> </ul>

### Assessment Strategies

The Learner:

- writes a report and makes a presentation about the tour.
- makes a return demonstration.
- participates in the discussion.
- does homework on noise and dust pollution.

**Resources**

- Protective gears
- Notebook and pen
- Documentary
- Internet
- Power point, slides
- Charts
- Hand gloves

**Sub-module 3: Industrial Effluents**

Duration: 12 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>• assesses the impact of effluent on the environment and suggests how to limit it.</li> <li>• provides ways and measures of controlling such pollution.</li> <li>• applies rules and regulations to protect and preserve environment.</li> </ul>	<ul style="list-style-type: none"> <li>• Environmental impact Assessment</li> <li>• Pollution control: noise dust chemicals</li> <li>• Environment legislation</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided tour of NEMA for the learner to know environmental impact assessment, pollution control, and environmental legislation.</li> <li>• Lead a guided discussion on environmental impact assessment, pollution control and environmental legislation.</li> </ul>

**Assessment Strategies**

The learner writes and presents a report about the tour.

**Resources**

- Notebook and pen
- Industrial shoes,
- Gloves and overalls
- Documentary
- Internet
- Chalkboard/writing board

- Computer
- Power point, slides

## Sub-module 4: Safety and Security

Duration: 12 Hours

Competences	Content	Teaching Strategies
<b>The learner:</b> <ul style="list-style-type: none"> <li>• carries out first aid administration.</li> <li>• sensitises the public on safety awareness.</li> <li>• takes safety precaution and puts on safety gears.</li> <li>• writes and displays notices on designated areas.</li> </ul>	<ul style="list-style-type: none"> <li>• First aid</li> <li>• Safety education and posters</li> <li>• Safety from machinery</li> <li>• Safety wear</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided class discussion on first aid administration and safety measures required when administering first aid.</li> <li>• Lead a guided tour of the industry for the learner to observe how safety and first aid are carried out.</li> </ul>

### Assessment Strategy

The learner does the test on pollution control first aid and safety measures.

### Resources

- Notebook and pen
- Industrial shoes,
- gloves and overalls
- Documentary
- Internet
- Computer
- Power Point, slides

## TDCR 124: Ceramic Design

Duration: 60 Hours

### Module Overview

This module equips the learners with the current and modern elements of ceramic design and modelling.

### Learning Outcome

By the end of this module, the learner should be able to develop creative designs of ceramic articles to the customer's satisfaction.

### Preparatory Assignment

Before teaching this module, ask the learner to write about basic considerations in the design of a teapot and make a sketch of the teapot first, then a drawing of the pot to any chosen scale.

### Result

The learner sketches the teapot, develops the drawing of the pot to any chosen scale, writes a report and makes group presentation in the class.

## Sub-module 1: Introduction Ceramic Design

Duration: 14 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>describes elements of basic design</li> <li>mixes colours to obtain required texture</li> </ul>	<ul style="list-style-type: none"> <li>Elements of basic design.</li> <li>Colour</li> <li>Tone.</li> <li>Texture</li> </ul>	<ul style="list-style-type: none"> <li>Brain storm on elements of basic design.</li> <li>Lead a guided tour of design centres for the learner to observe various colour mixing techniques and textures.</li> <li>Demonstrate practically colour mixing, toning and ask the learner to make a return demonstration.</li> </ul>

### Assessment Strategies

The learner:

- practically mixes colours, carries out the toning and surface application.
- does homework on elements of basic design.

### Resources

- Different colours
- Container
- Colour mixer
- Art brush
- Documentary
- Textbooks
- Internet
- Power point
- Models

## Sub-module 2: Design Factors

Duration: 16 Hours

Competences	Content	Teaching Strategies
<p><b>The learner:</b></p> <ul style="list-style-type: none"> <li>• describes factors affecting design and production of ceramic articles.</li> <li>• takes caution on factors affecting and apply factors governing design.</li> </ul>	<ul style="list-style-type: none"> <li>• Factors affecting design</li> <li>• Factors affecting production of ceramic articles.</li> <li>• Factors affecting /governing traditional design</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on factors governing, and affecting designs and factors affecting production of ceramic articles.</li> <li>• Lead a guided tour of design centres for the learner to identify various factors affecting and governing design and production of ceramic articles.</li> <li>• Illustrate on board the principles guiding ceramic designs and modelling, emphasising one's creativity and innovation.</li> </ul>

### Assessment Strategies

The learner:

- designs and models various ceramic articles.
- does assignment to design articles and as a class competition.

### Resources

- Different colours
- Container
- Colour mixer
- Art brush
- Documentary
- Textbooks
- Internet
- Power point
- Models

## Sub-module 3: Function of Design

Duration: 16 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>describes form and function of design.</li> <li>relates form to function when designing.</li> <li>designs articles on the basis of functional requirements.</li> </ul>	<ul style="list-style-type: none"> <li>Form</li> <li>Function</li> <li>Relation between form and function.</li> <li>Design of functional articles.</li> </ul>	<ul style="list-style-type: none"> <li>Guide a discussion on form and functions of ceramic designs.</li> <li>Demonstrate form and functions of ceramic designs.</li> <li>Guide the learner to a brainstorming session on the relation between form and function.</li> <li>Illustrate on board the design of articles basing on functional requirements.</li> </ul>

### Assessment Strategies

The learner:

- designs and makes ceramic articles in accordance with the functional requirements.
- does class work on the relation between form and function.

### Resources

- Different colours
- Container
- Colour mixer
- Art brush
- Documentary
- Textbooks
- Internet
- Power point
- Models

## Sub-module 4: Types of Design

Duration: 14 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>differentiates between workshop and industrial design.</li> </ul>	<ul style="list-style-type: none"> <li>Workshop design</li> <li>Industrial design</li> <li>Transfer papers</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided tour of ceramic industry or workshop for the learner to identify various workshop and industrial design methods.</li> <li>Lead a guided discussion on transfer papers and all other</li> </ul>

Competences	Content	Teaching Strategies
<ul style="list-style-type: none"> <li>applies transfer papers to design ceramic articles.</li> </ul>		various types of designs. <ul style="list-style-type: none"> <li>Illustrate on board the skills of transferring papers and other forms of designs.</li> </ul>

### Assessment Strategies

The learner:

- writes and presents a report.
- participates in the discussion.

### Resources

- Different colours
- Container
- Colour mixer
- Art brush
- Documentary

## NDCME 125: Real Life Project II

Duration: 60 Hours

### Module Overview

This module enhances the learner with modern methods of preparing a body and plaster of Paris for mould making.

### Learning Outcome

By the end of this module, the learner should be able to make a plaster working mould.

### Preparation Assignment

Before teaching this module, take the learner to clay quarries to observe the various processes of preparing a body and plaster of Paris.

### Result

The learner observes, takes note, writes reports and discusses in class.

## Sub-module 1: Body Preparation

Duration: 12 Hours

Competences	Content	Teaching Strategies
<p><b>The learner:</b></p> <ul style="list-style-type: none"> <li>• ferries materials.</li> <li>• Sorts and crushes materials.</li> <li>• soaks clay in troughs.</li> <li>• blunges and sieves clay slip.</li> <li>• drains water from clay slip.</li> <li>• pugs the plastic clay and cures the clay.</li> </ul>	<ul style="list-style-type: none"> <li>• Ferrying materials from storage place</li> <li>• Sorting of material.</li> <li>• Preliminary crushing of materials</li> <li>• Soaking of clay in troughs.</li> <li>• Blunging of clay</li> <li>• Sieving of clay slip</li> <li>• Spreading of clay slip to drain water from it</li> <li>• Plastic clay taken to pug mill</li> <li>• Plastic clay (body) taken for ageing</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided tour of ceramic factory for the learner to observe ferrying of materials from storage place.</li> <li>• Organise a guided tour of a ceramic workshop/ pottery studio for the learner to observe plastic clay preparation.</li> <li>• Demonstrate ferrying and preparing of clay for the learner to practice.</li> </ul>



### Assessment Strategies

The learner practically prepares a body, cures it, sets the firing, sets the temperatures and fires the products.

### Resources

- Raw materials,
- Crusher,
- Trough,
- Blunger
- Sieve,
- Clean surface,
- Pug mill,
- Dump room,
- Power point,
- Textbooks,
- Chart
- Slides

## Sub-module 2: Throwing Cylinders

Duration: 10 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• wedges plastic clay.</li> <li>• cuts clay into balls and centers clay on a wheel.</li> <li>• pulls clay to form a cylinder, trims and cut off the cylinder from the wheel top.</li> <li>• turns the cylinder.</li> </ul>	<ul style="list-style-type: none"> <li>• Clay fetching from store</li> <li>• Plastic clay wedging</li> <li>• Clay cutting into balls</li> <li>• Centring clay on wheel</li> <li>• Pulling clay to a cylinder</li> <li>• Trimming and cutting off the cylinder from the wheel top</li> <li>• Drying the cylinder to leather hard state and turn it</li> <li>• Turning the cylinders</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided tour of the pottery studio or workshop for the learner to observe throwing of cylinders.</li> <li>• Demonstrate the process of throwing cylinder and ask the learner to make a return demonstration.</li> <li>• Display the articles in leather hard state.</li> </ul>

### Assessment Strategy

The learner practically throws cylinders.

### Resources

- Plastic clay
- Working bench
- Potter's wheel
- Cutting wire

- Water
- Shaping tools
- Turning tools
- Sponge
- Boards and drying wrack
- Power point
- Drawing instruments
- *Pottery* by J.B
- Charts

### Sub-module 3: Throwing of Simple Articles

Duration: 24 Hours

Competences	Content	Teaching Strategies
<p><b>The learner:</b></p> <ul style="list-style-type: none"> <li>• centres a clay ball for a mug, cup, flower vase, water jar and bowl.</li> <li>• pulls the centred clay ball to a cylinder.</li> <li>• shapes the cylinder into any desired shape (mug, cup, flower vase, water jar and bowl).</li> </ul>	<ul style="list-style-type: none"> <li>• Cups</li> <li>• Mugs</li> <li>• Flower vases</li> <li>• Water jars and bowls</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided tour of a pottery studio for the learner to observe the process of throwing cups, mugs, flower vessels, bowl, and water jugs.</li> <li>• Demonstrate the throwing of cups, mugs, flower vases, water jugs, and bowls.</li> </ul>

#### Assessment Strategy

The learner practically throws of simple articles like cups, plates and flower vessels.

#### Resources

- Plastic clay
- Working bench
- Potter's wheel
- Cutting wire
- Water
- Shaping tools
- Turning tools
- Sponge
- Boards and drying wrack
- Power point
- Drawing instruments
- *Pottery* by J.B
- Petty
- Charts

## Sub-module 4: Production of Plaster Moulds

Duration: 8 Hours

Competences	Content	Teaching Strategies
<b>The learner:</b> <ul style="list-style-type: none"> <li>• produces a sketch of a mould.</li> <li>• makes a model.</li> <li>• produces a mould for ceramic articles.</li> </ul>	<ul style="list-style-type: none"> <li>• Producing models and moulds of simple articles</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided tour of a ceramic workshop or pottery studio to observe mould production.</li> <li>• Lead a discussion and demonstrate mould making, emphasising the techniques applied.</li> </ul>

### Assessment Strategy

The learner makes moulds.

### Resources

- Plastic clay
- Working bench
- Potter's wheel
- Cutting wire
- Water
- Shaping tools
- Turning tools
- Sponge
- Boards and drying wrack
- Power point
- Drawing instruments
- Charts

## Sub-module 5: Biscuit Firing

Duration: 6 Hours

Competences	Content	Teaching Strategies
<b>The learner:</b> <ul style="list-style-type: none"> <li>• loads and sets the kiln temperatures.</li> <li>• fires the articles in the kiln and allows cooling.</li> <li>• offloads the article from the kiln.</li> </ul>	<ul style="list-style-type: none"> <li>• Ferrying articles to kiln room</li> <li>• Kiln loading</li> <li>• Firing and allowing cooling.</li> <li>• Offloading articles</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided tour of a clay factory to observe firing process.</li> <li>• Lead a guided discussion and demonstrate on biscuit firing.</li> </ul>

### Assessment Strategy

The learner practically carries out biscuit firing.

### Resources

- Articles
- Fuel
- Kiln
- Documentaries

## TDCR 131: Industrial Training 1

Duration: 10 Weeks

### Module Overview

This module bridges any skills gap between the institutions and the industry as it exposes the learner to work challenges and management, thereby enabling them to acquire the required work experience.

### Learning Outcome

By the end of this module, the learner should be able to apply the acquired skills in manufacturing of ceramic products.

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>• wins clay.</li> <li>• determines physical properties of the clay.</li> <li>• sieves clay.</li> <li>• puts the slip in moulds.</li> <li>• removes clay from the moulds.</li> <li>• wedges clay.</li> <li>• stores clay.</li> <li>• blunges clay.</li> <li>• prepares clay balls.</li> <li>• centres clay balls.</li> <li>• pulls the cantered clay.</li> <li>• makes cylinders.</li> <li>• shapes in any desired shapes.</li> <li>• puts in damp room.</li> <li>• dries the articles.</li> <li>• sorts the articles and grades. them for sale.</li> <li>• observes health, safety and welfare.</li> <li>• acquaints with the industry.</li> <li>• relates with workers.</li> <li>• organises, administers</li> </ul>	<ul style="list-style-type: none"> <li>• Preparing a single body and making some table ware articles</li> <li>• Mining ball clay and transporting material</li> <li>• Determining physical properties of the clay</li> <li>• Preparing the clay</li> <li>• Preparing the clay body</li> <li>• Producing articles by hand forming method</li> <li>• Making flower vases, mugs, cups, coffee pots, teapots, bowls, water jars and heavy</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate winning of clay.</li> <li>• Lead a guided discussion on physical properties of the clay.</li> <li>• Demonstrate, sieving, casting slip, wedging, storing, preparation of clay balls, cantering, pulling, making cylinders, shaping ,fettling, drying, firing, sorting and grading for sale.</li> <li>• Place the learner for industrial training.</li> <li>• Lead a guided discussion on health, safety and welfare,</li> </ul>

Competences	Content	Teaching Strategies
and manages materials. • writes reports.	clay ware. • Drying the articles • Biscuit firing the items • Glost firing the article • Drying heavy clay ware	relating with workers, site organisation, material management. • Illustrate on board report writing aspects.

### Assessment Strategies

The learner:

- searches training places for industrial training and submits in an introductory letter.
- applies health, safety and welfare.
- relates with workers.

### Resources

- Log books
- Training manual
- Clay
- Sieves
- Moulds
- Levelled surface
- Damp room
- Storage bins
- Potter's wheel
- Sponge
- Cutting wire
- Gum boots
- Knives
- Ceramics by singer,
- Drying shades
- Kiln
- Buckets
- Gloves
- Overalls
- Helmets
- Trucks

## Description of Year 2 Semester 1

<b>Semester I: Core Project(s):</b>					
Construction of a Kiln using Local Materials					
<b>Code</b>	<b>Module Title (All Core Modules)</b>	<b>L</b>	<b>P</b>	<b>CH</b>	<b>CU</b>
<b>TDEM 211</b>	Engineering Mathematics III	60	0	60	4
<b>TDWE 211</b>	Geology and Soils	30	30	45	3
<b>TDAR 211</b>	Computer Aided Design	30	30	45	3
<b>TDCR 211</b>	Ceramics Technology III	30	30	45	3
<b>TDCR 212</b>	Materials Science II	30	30	45	3
<b>TDCR 213</b>	Ceramics Calculations	30	30	60	3
<b>TDCR 214</b>	Ceramics Concrete Works	30	30	45	3
<b>TDCR 215</b>	Real Life Project III - Kiln Construction	0	120	60	4
<b>Total</b>					<b>26</b>
<b>Semester Load = 26</b>					

## TDEM 211: Engineering Mathematics III

Duration: 60 Hours

### Module Overview

This module enriches the learner's ability to analyse and interpret data using statistical approaches.

### Module Learning Out Come

By the end of this module, the learner should be able to group, analyse, represent and interpret data.

### Preparatory Assignment

The learner is given to estimate the amount of clay and other raw materials required to make a particular design of cups.

### Result

The learner collects data, analyses it, writes a report and makes a presentation in groups.

## Sub-module 1: Sequence and Series

Duration: 20 Hours

Competences	Content	Teaching Strategies
<p><b>The learner:</b></p> <ul style="list-style-type: none"> <li>applies sequence and series equations in solving electrical flow of currents.</li> <li>applies the binominal series during the animation of the developed structural plans and designs for dams and water treatment plants.</li> <li>evaluates equations using power series, tailor series, uniform</li> </ul>	<ul style="list-style-type: none"> <li>Sequences, series, arithmetic and geometric series</li> <li>Methods of summation of finite series</li> <li>Convergence principle for series, monotone real series</li> <li>Leibniz test for real series, tests for divergence and convergence of series</li> <li>The binomial series, partial fractions</li> <li>The binomial expansion,</li> </ul>	<ul style="list-style-type: none"> <li>Illustrate on board the methods of manipulating sequences and series.</li> <li>Demonstrate the performance of sequences and series in electrical wiring, giving examples in power fluctuations.</li> <li>Illustrate power series, tailor</li> </ul>

Competences	Content	Teaching Strategies
convergences.	exponential and related series, the logarithmic series <ul style="list-style-type: none"> <li>• Power series, tailor series, uniform convergences</li> </ul>	series, uniform convergences.

### Assessment Strategies

The learner:

- practises manipulation of sequences and series.
- does exercise on binomial series.
- does assignment on power series, tailor series, uniform convergences.

### Resource

Scientific calculator

## Sub-module 2: Probability Theorem

Duration: 20 Hours

Competences	Content	Teaching strategies
<b>The learner:</b> <ul style="list-style-type: none"> <li>• applies the probability theorem in predicting, subscribing for insurance and managing construction risks of fire, life and property.</li> <li>• determines the variance and correlation of data.</li> <li>• differentiates between discrete and continuous distributions.</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction, conditional probability, partitions, total probability, mathematical expectation and probability</li> <li>• Generating functions, random variables, discrete and continuous distributions, common distributions: Binomial, normal, exponential and variance.</li> </ul>	<ul style="list-style-type: none"> <li>• Clarify the rules of probability theories.</li> <li>• Lead a group discussion on conditional probability as used in the world of engineering.</li> <li>• Illustrate the application of random variables, discrete and continuous distributions, and common distributions: binomial, normal, variance, giving examples.</li> </ul>



### Assessment Strategies

The learner does exercise on continuous variables and frequency distributions.

### Resource

Scientific calculators

## Sub-module 3: Statistics

Duration: 20 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>records and groups data.</li> <li>manipulates data and makes frequency distribution table.</li> <li>determines the mean, average, mode, standard deviation and assumed mean.</li> </ul>	<ul style="list-style-type: none"> <li>Population and sample</li> <li>Discrete and continuous variables</li> <li>Graphs</li> <li>Frequency distributions</li> <li>Calculation on mean, median, mode, variance and standard deviation</li> <li>Moments and skewness.</li> </ul>	<ul style="list-style-type: none"> <li>Discuss and illustrate the applications of histograms.</li> <li>Illustrate on board data recording techniques and making of frequency distribution tables.</li> <li>Illustrate by calculating on board the average, mean, assumed mean and standard deviation, giving data related examples.</li> <li>Call one learner to make a return illustration on calculating the standard deviation.</li> </ul>

### Assessment Strategy

The learner records data makes frequency distribution tables and represents information in the histogram graph.

## TDWE 211: Geology and Soils

### Year 2 Semester 1

Duration: 60 Hours

#### Module Overview

This module enriches the learner with the knowledge and application of soils, rocks, minerals, and their geological features.

#### Learning Outcome

By the end of this module, the learner should be able to determine the groundwater quality purification and flow patterns within the different types of rocks in the ground.

#### Preparatory Assignment

Take learner to visit geological department and ask him/her to identify the different rocks and minerals. Or take learner to any nearby shallow well or spring well and ask him/her to discuss the findings.

#### Result

The learner discusses the different rock formations, characteristics, properties and application.

### Sub-module 1: Introduction to Geology

Duration: 6 Hours

Competences	Content	Teaching Strategies
The learner describes surfaces and interior of the earth, the continental drift and plate tectonic.	<ul style="list-style-type: none"> <li>• Earth surface</li> <li>• The interior of the earth,</li> <li>• Continental drift,</li> <li>• Plate tectonic,</li> <li>• Earth age and origin and stratigraphical representation, precambrian, phanerozoic, mesozoic and cenozoic</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on earth surface, continental drift and plate tectonics.</li> <li>• Illustrate with drawings the interior of the earth.</li> <li>• Demonstrate with models continental drift and plate tectonics.</li> <li>• Guide the learner to excavate the trial pit and extract soil samples to represent soil strata.</li> </ul>

## Assessment Strategies

The learner excavates trial pit and extracts soil samples to represent soil strata.

## Resources

- Soil samples
- Rock sample
- Glass plate
- Internet
- Geology handbook

## Sub-module 2: Structural Geology

Duration: 14 Hours

Competences	Content	Teaching Strategies
<p><b>The learner:</b></p> <ul style="list-style-type: none"> <li>• identifies and illustrates using drawings of the geological folds, faults and joints.</li> <li>• describes the formation of joints.</li> </ul>	<ul style="list-style-type: none"> <li>• General introduction, attitude and beds</li> <li>• Folds: (antiform, anticline, synform and syncline), and engineering considerations involved when dealing with folded rocks, fold geometry</li> <li>• Faults: definition, (normal, reverse, thrust, wrench), recognition of faulting in the field, causes, effects and engineering considerations involved when dealing with the faulted rocks,</li> <li>• Joints: description, nature and attitude, classifications, types, in different rocks and engineering considerations involved when dealing with the jointed rocks, and unconformities</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on folds, faults and joints.</li> <li>• Illustration with drawings the folds, faults and joints.</li> <li>• Demonstrate with models the folds, faults and joints.</li> <li>• Show a documentary film on folds, faults and joints.</li> </ul>

**Assessment Strategies**

The learner:

- illustrates folds, faults and joints on their notebook.
- analyses the formation of folds, faults, joints on a documentary, discusses and writes a report.

**Resources**

- Soil samples
- Rock sample
- Glass plate
- Internet
- Geology handbook

**Sub-module 3: Elementary Mineralogy**

Duration: 8 Hours

Competences	Content	Teaching Strategies
<p><b>The learner:</b></p> <ul style="list-style-type: none"> <li>• classifies rocks, minerals and describes the importance and uses in construction.</li> <li>• describes physical, chemical and, microscopic optical properties of minerals, identifying feature.</li> <li>• identifies rock forming minerals and their importance.</li> <li>• discusses importance of drainage and behaviour of rock</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction: general to rocks and minerals</li> <li>• Elements and compounds and their definitions</li> <li>• Classification of minerals, their uses and physical, chemical and, microscopic optical properties of minerals, identifying feature (colour, streak, cleavage, fracture, hardness, lustre, crystal habit, specific gravity, transparency, tenacity)</li> <li>• Rock forming</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on mineralogy, its elements and compounds.</li> <li>• Demonstrate rock forming with samples of minerals to the learner and ask him/her to identify minerals involved.</li> <li>• Give assignment on rock forming minerals and their importance.</li> </ul>

Competences	Content	Teaching Strategies
and soil and failures of rocks.	minerals and their importance, clay and non – silicate minerals, mineral accumulation <ul style="list-style-type: none"> <li>• Influence of geological history</li> <li>• Importance of drainage and behaviour of rock and soil and failures of rocks</li> </ul>	

### Assessment Strategies

The learner:

- does assignment on rock forming minerals and their importance.
- does class work on influence of geological history, and importance of drainage and behaviour of rock and soil and failures of rocks.

### Resources

- Flip charts
- Relevant textbooks

## Sub-module 4: Origin, Classification and Properties of Rocks

Duration: 10 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• describes the formation of rocks.</li> <li>• selects and uses rocks in the construction industry.</li> <li>• converts rocks into</li> </ul>	<ul style="list-style-type: none"> <li>• Major rock groups (igneous, sedimentary, metamorphic) formation, composition</li> <li>• Rock classification exercise</li> <li>• Engineering properties of rocks: index properties</li> </ul>	<ul style="list-style-type: none"> <li>• Lead guided discussion on classification of rocks and properties.</li> <li>• Demonstrate how rocks can be converted into aggregates using local tools.</li> <li>• Take the learner to a quarry site to identify the type of rock, manipulation of rocks</li> </ul>

Competences	Content	Teaching Strategies
standard aggregates.	(rebound number, unconfined compressive strength, and swelling coefficient), raw materials for aggregates for roads and concrete, rock as a fill material	into aggregates. <ul style="list-style-type: none"> <li>Lead a guided discussion on origin, classification and properties rocks.</li> </ul>

### Assessment Strategies

The learner converts rocks into aggregates by manually breaking using hammers.

### Resources

- Flip charts
- Relevant textbooks
- Sample of rocks

## Sub-module 5: Weathering and Denudation

Duration: 8 Hours

Competences	Content	Teaching Strategies
<b>The learner:</b> <ul style="list-style-type: none"> <li>describes the erosive mechanisms on rivers, seas, wind, ice, and running water.</li> <li>controls soil erosion.</li> </ul>	<ul style="list-style-type: none"> <li>Types of weathering (chemical, mechanical and biological) and processes</li> <li>Erosive mechanisms (rivers, seas, wind, ice, and running water) deposition and geological work associated with them</li> </ul>	<ul style="list-style-type: none"> <li>Show a documentary on weathering.</li> <li>Lead a guided discussion on weathering and denudation.</li> <li>Lead study visits to geological features associated with weathering.</li> <li>Lead guided discussion on erosive mechanisms on rivers, seas, wind, ice, and running water.</li> </ul>

### Assessment Strategy

The learner opens Internet search and does assignment on erosive mechanisms of rivers, seas and lakes.

### Resources

- Chalk board/writing board
- Flip charts
- Relevant textbooks
- Computer
- Overhead projector

## Sub-module 6: Site Investigation

Duration: 14 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• excavates trial pits and make an evaluation on type of soil and ground water present.</li> <li>• writes the site investigation report.</li> </ul>	<ul style="list-style-type: none"> <li>• General, techniques employed: desk study, types of samples and reasons, organising effective site investigations</li> <li>• Methods: trial pits, percussion boring, mechanical augers, wash boring, rotary drilling</li> <li>• Sampling: sampler types (open drive, thin walled, split barrel, stationary position) procedure</li> <li>• Reports: boring, drilling and site investigation reports,/ logs</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on site orientation.</li> <li>• Carry out trial pitting and soil sampling.</li> <li>• Illustrate with drawings soil strata.</li> <li>• Lead a guided discussion on site orientation and its importance.</li> </ul>

### Assessment Strategy

The learner excavates the trial pit manually and also by using mechanical hand augers, extracts soil samples and measures each stratum.

### **Resources**

- Flip charts
- Documentary about compaction
- Soil samples
- Relevant textbooks
- Pickaxe



# TDAR 211: Computer Aided Design

**Year 2 Semester 1**

Duration: 60 Hours

## Module Overview

This module equips the learner with the skills of using the computer for designing and drawing building plans and other related facilities using computer packages such as Auto CIVIL, AutoCAD, ArchCAD.

## Learning Outcome

By the end of this module, the learner should be able to use computer packages such as AutoCAD, Arch CAD and Auto Civil to design and draw details of building plans and other facilities.

## Preparatory Assignment

Before teaching this module, the learner is asked to draw a simple one-roomed pump house plan using MS Word.

## Result

The learner draws and presents the class exercise for marking.

## Hints to the Teacher

- i) Start teaching AutoCAD first as it relates to the drawing board skills
- ii) When the learner masters AutoCAD, then the other drawing programmes will be simple for the learner to master BUT when he/she learns ArchiCAD first, he/she will never master AutoCAD, he/she will become very lazy and he/she will view AutoCAD as a very difficult programme to learn
- iii) It is worth acknowledging that the person teaching the learner this module should be having full knowledge of Architecture, Civil and Water Engineering and Ceramics in order to avoid misguiding the learner

## Sub-Module 1: Introduction

Duration: 8 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• views, dimensions, and modifies drawings.</li> <li>• sets a drawing</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction to practical work in applications packages such as AutoCAD</li> </ul>	<ul style="list-style-type: none"> <li>• Describe the process of starting, creating, opening and saving files.</li> <li>• Illustrate modifying a</li> </ul>

Competences	Content	Teaching Strategies
sheet at appropriate scale. <ul style="list-style-type: none"> <li>prints tile block and notes.</li> </ul>	<ul style="list-style-type: none"> <li>File management</li> <li>Drawing</li> <li>Viewing a drawing</li> <li>Dimensioning</li> <li>Modifying a drawing</li> <li>Size of drawing, drawing coordinates and layout,</li> <li>Scale</li> <li>Tile block and notes</li> <li>Line thickness</li> </ul>	drawing. <ul style="list-style-type: none"> <li>Demonstrate scaling, making title blocks and notes.</li> <li>Guide the learner on the techniques of creating and modifying a drawing.</li> </ul>

### Assessment Strategy

The learner sets drawing sheets, drawing limits, drawing units, and manages file.

### Resources

- Computer
- Projector

## Sub-module 2: File Management

Duration: 4 Hours

Competences	Content	Teaching Strategies
<b>The learner:</b> <ul style="list-style-type: none"> <li>creates a new file, saves and opens a file.</li> <li>recovers lost file.</li> </ul>	<ul style="list-style-type: none"> <li>Creating new files; saving a file, opening a file</li> <li>Exporting, publishing, recovering</li> <li>Sending</li> </ul>	<ul style="list-style-type: none"> <li>Describe the AutoCAD commands, the techniques of setting and displaying or hiding the commands from the screen.</li> <li>Demonstrate how to create new files, save a file, and open a file.</li> <li>Demonstrate how to send, and publish an AutoCAD drawing.</li> </ul>

### Assessment Strategies

The learner practically creates new files, saves a file, and opens a file.

## Resources

- Computer
- Projector

## Sub-module 3: Drawing

Duration: 10 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• creates and uses layers.</li> <li>• hatches objects: boundary, regions and cloud.</li> </ul>	<ul style="list-style-type: none"> <li>• Creation of layers</li> <li>• Line ray, construction line, multi line</li> <li>• Polyline, 3D polyline, polygon, rectangle</li> <li>• Arch circle donut, ellipse, spline</li> <li>• Block, point</li> <li>• Hatch, boundary, region, cloud</li> </ul>	<ul style="list-style-type: none"> <li>• Describe the construction of line ray, construction line, and multi line.</li> <li>• Illustrate creation and application of layers, angle lines, fonts, colours and dimensions.</li> <li>• Demonstrate the techniques applied when carrying out hatching, boundary, region, and cloud.</li> </ul>

## Assessment Strategies

The learner **creates** layers in AutoCAD, set, and hatches boundaries, region, and cloud to represent a respective symbol.

## Resources

- Computer
- Projector

## Sub-module 4: Methods for Viewing Drawing

Duration: 6 Hours

Competences	Content	Teaching Strategies
The learner redraws, zooms, pans, shades, and renders drawn objects.	<ul style="list-style-type: none"> <li>• Regenerating</li> <li>• Redrawing</li> <li>• Zooming</li> <li>• Panning</li> <li>• Hiding, shading and rendering</li> <li>• 3 dimension</li> </ul>	<ul style="list-style-type: none"> <li>• Describe the techniques of zooming and real panning, selecting and applying 3D orientation UCS.</li> <li>• Illustrate hiding drawn work, shading and rendering.</li> </ul>

### Assessment Strategy

The learner draws objects and practices zooming and real duration pan, hiding, shading and rendering drawings.

### Resources

- Computer
- Projector

## Sub-module 5: Dimensioning

Duration: 6 Hours

Competences	Content	Teaching Strategies
<p><b>The learner:</b></p> <ul style="list-style-type: none"> <li>• applies linear and aligned dimension styles appropriately.</li> <li>• sets and changes text and dimension style properties.</li> </ul>	<ul style="list-style-type: none"> <li>• Linear, aligned, ordinate</li> <li>• Radius diameter angular</li> <li>• Baseline, text, dimension styles</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate the skills of setting dimensions, modifying dimensions, selecting and applying linear, aligned and ordinate dimensioning styles, the continue command.</li> <li>• Demonstrate changing text properties and dimension style and editing of a dimension.</li> </ul>

### Assessment Strategies

The learner draws dimension and applies dimension styles and properties.

### Resources

- Computer
- Projector

## Sub-module 6: Modifying a Drawing

Duration: 10 Hours

Competences	Content	Teaching Strategies
<b>The learner:</b> <ul style="list-style-type: none"> <li>• matches properties of objects, modifies a drawing by use of erase, copy, offset, trim, lengthen, array and scale.</li> <li>• makes drawn objects blocks and explode objects.</li> </ul>	<ul style="list-style-type: none"> <li>• Match properties, object, clip</li> <li>• Erase, copy, offset, array</li> <li>• Move, rotate, scale, stretch, lengthen</li> <li>• Trim, extend, break, chamfer, fillet</li> <li>• 3D operation, solid edit,</li> <li>• Explode</li> </ul>	<ul style="list-style-type: none"> <li>• Illustrate the procedure of matching properties of an object.</li> <li>• Demonstrate skills applied in copying, offsetting, trimming and lengthening.</li> <li>• Describe the process of exploding an object.</li> <li>• Demonstrate the techniques applied in chamfering, filleting mirroring an object.</li> <li>• Give assignment on chamfering and filleting an object.</li> </ul>

### Assessment Strategies

The learner matches properties, copies, offsets, trims, extends objects, fillets and chamfers drawings.

### Resources

- Computer
- Projector

## Sub-module 7: Production of Architectural Drawing

Duration: 10 Hours

Competences	Content	Teaching Strategies
<b>The learner:</b> <ul style="list-style-type: none"> <li>• prepares drawing layouts, title</li> </ul>	<ul style="list-style-type: none"> <li>• Review of drawing layout: Title block,</li> </ul>	<ul style="list-style-type: none"> <li>• Describe the orientation and</li> </ul>

blocks and makes notes panel. <ul style="list-style-type: none"> <li>• orients the site, makes ground, block, and site location plans.</li> <li>• draws ground floor plans, sections and details and elevations.</li> <li>• prints drawings and submits for approvals.</li> </ul>	Notes, Paper sizes, <ul style="list-style-type: none"> <li>• Considerations of site orientation, economy, aesthetics, facilities for disabled, fire safety,</li> <li>• Block plan, site plan, ground plan</li> <li>• Sections and elevations</li> <li>• Details</li> <li>• Plotting</li> </ul>	layout of a drawing, spacing between drawings and specification writings. <ul style="list-style-type: none"> <li>• Demonstrate production of a plan, sections, elevations and details from the ground plan, emphasising the offsetting skills.</li> <li>• Describe the process of plotting a drawing.</li> </ul>
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### Assessment Strategy

The learner draws a simple 2 stance VIP, with plan, front and rears elevation and section.

### Resources

- Computer
- Projector

## Sub-module 8: Plumbing and Sanitation Details

Duration: 6 Hours

Competences	Content	Teaching Strategies
<b>The learner:</b> <ul style="list-style-type: none"> <li>• draws plumbing and drainage installation details.</li> <li>• writes specification notes for materials, works, safety and labour.</li> </ul>	<ul style="list-style-type: none"> <li>• Plumbing and drainage drawings</li> </ul>	<ul style="list-style-type: none"> <li>• Describe the process of applying plumbing and drainage drawings in AutoCAD and their relationship to ground plans.</li> <li>• Demonstrate the process of making templates of plumbing and drainage using AutoCAD.</li> </ul>

### **Assessment Strategy**

The learner locates plumbing and drainage facilities and draws them using AutoCAD.

### **Resources**

- Computer
- Projector

## NDCME 211: Ceramics Technology III

Duration: 60 Hours

### Module Overview

This module equips the learner with skills and techniques of producing ceramic bodies and applying glazes on biscuit wares.

### Learning Outcome

By the end of this module, the learner should be able to produce the ceramic bodies.

### Preparatory Assignment

Before teaching this module, display various ceramic bodies and task the learner to analyse the materials used and the surface finish produced.

### Results

The learner discusses and presents their findings in groups.

## Sub-module 1: Body preparation

Duration: 10 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>prepares raw materials by sieving/grinding.</li> <li>produces and shapes the material to the required particle size.</li> <li>measures the constituent materials according to the required body formula.</li> <li>uses the blunger to mix the material and a filter press to reduce the water.</li> <li>appreciates the importance of storing the plastic clay.</li> </ul>	<ul style="list-style-type: none"> <li>Prepare raw materials by sieving/grinding</li> <li>Mix according to required proportions</li> <li>Blunge to the required fineness</li> <li>Filter press the slip and remove filter cakes</li> <li>Pug the plastic clay</li> <li>Store plastic clay for ageing.</li> </ul>	<ul style="list-style-type: none"> <li>Demonstrate the preparation of material to produce a ceramic body.</li> <li>Show a documentary on the process of preparing material to produce a ceramic body and allow discussion session about the documentary.</li> </ul>



### Assessment Strategy

The learner prepares raw material by grinding and sieving.

### Resources

- Flip charts
- Documentary
- On-line sources
- Weighing scale
- Blunger, pug mill and filter press.

## Sub-module 2: Casting slip

Duration: 10 Hours

Competences	Content	Teaching Strategies
<b>The learner:</b> <ul style="list-style-type: none"> <li>• analyses the properties of slip.</li> <li>• describes types of slips.</li> <li>• designs the mechanisms of slip casting.</li> </ul>	<ul style="list-style-type: none"> <li>• Properties of slip</li> <li>• Types of slips</li> <li>• Mechanism of casting</li> </ul>	<ul style="list-style-type: none"> <li>• Display the casted slip and ask the learner to analyse its properties and write a report and present in groups.</li> <li>• Demonstrate the techniques of developing the moulds and frames for slip casting.</li> <li>• Show a documentary on the process of casting slip.</li> </ul>

### Assessment Strategies

The learner:

- prepares raw material by grinding and sieving.
- does assignment on cast slip.

### Resources

- Flip charts
- Documentary
- On-line sources
- Weighing scale
- Blunger, pug mill and filter press
- Raw materials

## Sub-module 3: Heavy Clay Ware

Duration: 10 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>chooses the correct methods of mining, loading and transportation.</li> <li>selects tools and equipment/machinery used in mining.</li> <li>illustrates the preparation of raw materials and body.</li> <li>demonstrates the various methods of forming heavy clay ware.</li> <li>uses various types of dryers for the drying process.</li> </ul>	<ul style="list-style-type: none"> <li>Winning of raw materials</li> <li>Machinery</li> <li>Preparation of raw materials</li> <li>Body preparation</li> <li>Forming methods</li> <li>Drying and dryers</li> <li>Drying of heavy clay ware</li> </ul>	<ul style="list-style-type: none"> <li>Show a documentary on methods of mining, loading and transportation of ceramic clay.</li> <li>Lead a guided discussion on methods of mining, loading and transportation of clay.</li> <li>Take the learner to the quarry sites; ask the quarry manager to demonstrate process of mining, tools and equipment used, preparation and storage of raw materials and drying of heavy clay ware. Task the learner to discuss the quarry findings, write a report and present in groups.</li> </ul>

### Assessment Strategies

The learner:

- discusses the quarry findings, writes a report and presents in groups to the class.
- gives the learner assignment on drying of heavy clay ware.

### Resources

- Flip charts
- Relevant text
- On-line sources
- Documentary

## Sub-module 4: Firing of Heavy Clay Ware

Duration: 20 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>operates different types of kilns.</li> <li>controls the kiln temperatures during firing process for heavy clay ware.</li> <li>selects the suitable types of fuel and burners used in kilns.</li> </ul>	<ul style="list-style-type: none"> <li>Kilns and firing</li> <li>Kiln refractory and furniture</li> <li>Types of kilns used in heavy clay ware</li> <li>Kiln control.</li> <li>Fuels and burners</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on kilns and firing, kiln refractory and furniture, types of kilns used in heavy clay ware, kiln control, fuels and burners.</li> <li>Take the learner to heavy clay factory like Uganda Clays and ask the plant manager to show the learner the existing kiln, its structural construction detail, type of fuel and how it's used during firing.</li> <li>Show a documentary on heavy clay factory operations.</li> </ul>

### Assessment Strategy

The learner does assignment on kilns and firing, kiln refractory and furniture, types of kilns used in heavy clay ware, kiln control, fuels and burners.

### Resources

- Flip charts
- Relevant text
- On-line sources
- Documentary

## Sub-module 5: Refractories and Insulators

Duration: 10 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>chooses the refractories materials and</li> </ul>	<ul style="list-style-type: none"> <li>Introduction to refractories</li> <li>Theories of manufacture</li> </ul>	<ul style="list-style-type: none"> <li>Guide a discussion on refractory materials and their methods of</li> </ul>

Competences	Content	Teaching Strategies
manufactures them. <ul style="list-style-type: none"> <li>• categorizes refractories and their application.</li> </ul>	<ul style="list-style-type: none"> <li>• Materials</li> <li>• Methods of manufacture</li> <li>• Classification of refractories</li> <li>• Applications of refractories</li> </ul>	manufacture. <ul style="list-style-type: none"> <li>• Show a documentary on refractories and their application.</li> <li>• Give a test on classification of refractories, refractory and furniture for kilns used in firing of heavy clay ware.</li> </ul>

### Assessment Strategies

The learner:

- writes a report and presents.
- does test on classification of refractories, refractory and furniture for kilns used in firing of heavy clay ware.

### Resources

- Flip charts
- Relevant text
- On-line sources
- Documentary
- Samples of different refractories

## TDCR 212: Materials Science II

Duration: 60 Hours

### Module Overview

This module enriches the learner with further analysis of chemical, physical and electrical properties of ceramic materials.

### Learning Outcome

By the end of this module, the learner should be able to carry out further tests on ceramic materials to establish the life and serviceability.

### Preparatory Assignment

Prior to teaching this module, take the learner to visit the Central Materials Laboratory (Ministry of Works and Housing) and the Industrial Research Institute (Ministry of Commerce and Industry) to appreciate the different activities that take place there during testing of materials.

### Results

The learner discusses the findings of the visit and relates them to the required materials properties.

## Sub-Module 1: Properties of Materials

Duration: 8 Hours

Competences	Content	Teaching Strategies
<b>The learner:</b> <ul style="list-style-type: none"> <li>analyses the physical and chemical properties of materials.</li> <li>determines the densities of materials.</li> <li>establishes the melting points, stress and strain of various materials.</li> <li>illustrates stress-strain curves of</li> </ul>	<ul style="list-style-type: none"> <li>Selected materials by their physical appearance</li> <li>Test materials</li> <li>Selected the materials on the basis of their densities</li> <li>Calculating the melting points, stress and strain of materials</li> <li>Protecting the materials against corrosion</li> <li>Drawing stress-strain curves of</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on physical and chemical properties of materials.</li> <li>Guide the learner to test materials.</li> <li>Lead a guided tour of the material laboratory for the learner to test on physical and chemical properties of various materials.</li> <li>Guide on calculating the melting points, stress and strain of materials.</li> <li>Demonstrate drawing stress-strain curves of</li> </ul>

Competences	Content	Teaching Strategies
various materials.	various materials	various materials.

### Assessment Strategies

The learner:

- tests the physical and chemical properties of various ceramic materials.
- does homework on calculating the melting points , stress and strain and drawing stress- strain curves of various materials.

### Resources

- Materials
- Internet
- Display charts
- Computer
- Power Point, slides

## Sub-module 2: Mechanical Behaviour

Duration: 12 Hours

Competences	Content	Teaching strategies
<p>The Learner:</p> <ul style="list-style-type: none"> <li>• selects and calculates the materials basing on their elastic module and strength.</li> <li>• designs ceramic products on the basis of failure theories.</li> <li>• carries out thermal shock tests on materials.</li> <li>• applies ceramic products on the basis of their ductility, fatigue,</li> </ul>	<ul style="list-style-type: none"> <li>• Elastic module</li> <li>• Strength</li> <li>• Fracture and hardness of ceramics</li> <li>• Thermal shock resistance</li> <li>• Creep of ceramics</li> <li>• Failure theories in materials</li> <li>• Ductility and fatigue</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on mechanical behaviour of materials, elastic strength, thermal shock, fracture and hardness.</li> <li>• Group the learner to brainstorm mechanical properties of materials.</li> <li>• Illustrate on board the design of ceramic products basing on failure theories.</li> </ul>

Competences	Content	Teaching strategies
fracture and hardness properties.		<ul style="list-style-type: none"> <li>Demonstrate shock tests for materials.</li> </ul>

### Assessment Strategies

The learner:

- designs the ceramic products based on the failure theories.
- does assignment on failure theories in materials, ductility and fatigue.

### Resources

- Materials
- Textbooks
- Internet
- charts

## Sub-Module 3: Electrical Properties

Duration: 16 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>carries out tests on ceramic products to determine their electrical and magnetic properties.</li> <li>determines the resistivity of pure and improved metals.</li> <li>designs ceramic products on the basis of dielectric and magnetic properties.</li> </ul>	<ul style="list-style-type: none"> <li>Introduction to electrical properties</li> <li>Classical theory of electrical conduction in metals</li> <li>Electron scattering.</li> <li>Resistivity of pure and improved metals</li> <li>Dielectric and magnetic properties of ceramic materials</li> <li>Properties of economic semi-conductor</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on electrical and magnetic properties of metals and ceramic materials.</li> <li>Guide the learner to brainstorm ideas on electron scattering resistivity of pure and improved metals; dielectric and magnetic properties of ceramic materials.</li> <li>Guide a tour of the material laboratory to learn about the electrical and magnetic properties of various materials.</li> </ul>

**Assessment Strategy**

The learner does test on the electrical properties of materials.

**Resources**

- Assortment of metals
- Internet
- Power point
- Projector
- Notebook and pen

## Sub-module 4: Mechanical Properties of Ceramics

Duration: 16 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• draws kinetic and structural curves of various ceramic material.</li> <li>• describes thermal properties of ceramic materials.</li> </ul>	<ul style="list-style-type: none"> <li>• Theoretical considerations</li> <li>• Reactions in Ceramic systems</li> <li>• Thermal properties of ceramic materials</li> <li>• Kinetic and structural study of reactions</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided theoretical discussion on mechanical properties of ceramic materials.</li> <li>• Demonstrate selection of the ceramic materials basing on their reactions.</li> <li>• Demonstrate drawing of kinetic and structural curves of various ceramic materials, illustrating the calculations applied.</li> </ul>

**Assessment Strategy**

The learner selects suitable ceramic materials based on their properties.

**Resources**

- Materials
- Charts
- Internet
- Computer
- Projector



## Sub-module 5: Optical Properties of Ceramics

Duration: 8 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>describes refractive index of ceramic products.</li> <li>selects ceramic product with desired dispersion properties.</li> </ul>	<ul style="list-style-type: none"> <li>Refractive Index</li> <li>Dispersion</li> <li>Transmittance</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on optical properties of ceramics.</li> <li>Conduct a practical on refractive index test on ceramic products.</li> </ul>

### Assessment Strategies

The learner:

- practically carries out refractive index test on ceramic products.
- does a test on optical properties of ceramics.

### Resources

- Ceramic materials
- Internet
- Charts
- Documentary
- Drawing instruments
- Computer

## TDCR 213: Ceramics Calculations

Duration: 60 Hours

### Module Overview

This module equips the learner with mathematical elements applied in determining ceramic constituent quantities used in ceramic manufacturing processes.

### Learning Outcome

By the end of this module, the learner should be able to determine the ceramic constituent quantities used and costs involved in the ceramic manufacturing processes.

### Preparatory Assignment

Before teaching this module, take the learner to the Government Industrial Research Institute and ceramic /pottery studios to ascertain the methods of formulating suitable body recipes for ceramic articles.

### Results

The learner visits the studio, asks the experts the questions on the methods applied to establish suitable body recipes, discusses, writes a report and makes group presentation in class.

## Sub-module 1: Elementary Calculations

Duration: 12 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>calculates the wet-fired contraction and volume shrinkage.</li> <li>recognises the influence of moisture content on volume shrinkage.</li> <li>relates moisture content to volume</li> </ul>	<ul style="list-style-type: none"> <li>Basic calculations</li> <li>Dimensional change</li> <li>Dry-fired contraction</li> <li>Wet-fired contraction.</li> <li>Volume shrinkage</li> <li>Moisture content:               <ul style="list-style-type: none"> <li>basis for the expression of percentage moisture content</li> <li>relationship between moisture content</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on elementary calculations as applied to ceramic industry.</li> <li>Illustrate on board the calculations for the dry and wet shrinkage: volume of clay body.</li> <li>Collect various samples of ceramic products and ask the learner to determine their dimensional changes and densities.</li> </ul>

Competences	Content	Teaching Strategies
shrinkage.	and volume shrinkage <ul style="list-style-type: none"> <li>• Loss-on-ignition</li> <li>• Density of a body</li> </ul>	<ul style="list-style-type: none"> <li>• Illustrate the methods of calculating the densities of products, emphasising the formulae used.</li> </ul>

### Assessment Strategies

The learner calculates the dimensional changes and densities of samples.

### Resources

- Display charts
- Plastic clay body
- Meter rule
- Scribing knife
- Rolling sticks
- Weighing scale
- Working table
- Scale rule

## Sub-module 2: Porous Solids

Duration: 12 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• determines the density of porous solids, apparent and true volume.</li> <li>• determines the percentage water absorption of materials.</li> </ul>	<ul style="list-style-type: none"> <li>• Calculating the density of porous solids</li> <li>• Appreciation of apparent and true volume</li> <li>• Interpretating porosity</li> <li>• Calculating porosity of a ceramic body</li> <li>• Describing percentage water absorption</li> <li>• Determining the percentage water absorption in a ceramic article</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on porous solids, advantages and their applications in ceramic wares.</li> <li>• Illustrate the method of calculating the porosity of materials.</li> <li>• Illustrate the percentage water absorption in the material.</li> </ul>

**Assessment Strategies**

The learner calculates the porosity of materials and water absorption percentage of materials.

**Resources**

- Dry biscuit samples
- Weighing scale
- Working table
- Enough water

**Sub-Module 3: Suspensions**

Duration: 6 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• calculates mixtures of solid particles and water.</li> <li>• interprets Brongniart's formula and describes the standard slope peck.</li> </ul>	<ul style="list-style-type: none"> <li>• Density of slip</li> <li>• Dilution problems</li> <li>• Calculations relating to mixtures of solid particles and water</li> <li>• Brongniart's Formula.</li> <li>• The Standard Slope Peck</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on suspensions, solving dilution and mixtures of solid particles and water.</li> <li>• Illustrate on board the calculation of mixtures of water and solid particles, the application of Brongniart's formula to calculate various variables.</li> </ul>

**Assessment Strategies**

The learner:

- calculates for the mixtures of water and solid particles, and apply Brongniart's formula to calculate various variables.
- does test on suspensions.

**Resources**

- Dry biscuit samples
- Clay slip
- Internet

## Sub-Module 4: Body Calculation

Duration: 10 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>calculates the percentage composition of a ceramic body.</li> <li>applies and interprets the batch and equivalent formula in glaze calculations.</li> </ul>	<ul style="list-style-type: none"> <li>Methods of expressing the composition</li> <li>Using the batch and equivalent formula to express composition of a Body</li> <li>Percentage</li> <li>Formula</li> <li>Calculations of percentage composition from the equivalent formula</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on body calculations, emphasising on the formulae used.</li> <li>Demonstrate the methods of expressing the composition of a body.</li> <li>Illustrate on board the derivation of equivalent formula.</li> </ul>

### Assessment Strategy

The learner derives the equivalent formula and applies it determining the ceramic bodies.

### Resources

- Dry biscuit samples
- Weighing scale

## Sub-Module 5: Glaze Calculations

Duration: 16 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>applies and classifies glaze constituents.</li> <li>calculates using the glaze formula given the recipe and equivalent (Seger) formula from the chemical analysis.</li> </ul>	<ul style="list-style-type: none"> <li>Introduction to glaze calculations</li> <li>Glass network formers</li> <li>Intermediates.</li> <li>Network modifiers</li> <li>Calculation of percentage composition</li> <li>Calculation of formula given the recipe</li> <li>Calculation of equivalent (Seger) formula from the chemical analysis</li> </ul>	<ul style="list-style-type: none"> <li>Illustrate on board the glaze constituents calculations.</li> <li>Illustrate the calculation of formula given the recipe and the procedure of calculating equivalent (Seger) formula from the chemical analysis.</li> </ul>

### Assessment Strategies

The learner:

- manipulates constituent calculations, given the recipe and the procedure of calculating equivalent Seger formula.
- does test on glaze calculations.

### Resources

- Dry biscuit samples
- Weighing scale

## Sub-module 6: Slip

Duration: 4 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>describes casting slip and casts the suitable slip.</li> <li>evaluates miscellaneous problems.</li> </ul>	<ul style="list-style-type: none"> <li>Casting slip</li> <li>Miscellaneous problems</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on casting slip.</li> <li>Demonstrate the procedure of producing casting slip and illustrate the calculations involved.</li> <li>Illustrate evaluation of miscellaneous problems.</li> </ul>

### Assessment Strategy

The learner writes assignment on casting slip.

### Resources

- Display charts
- Clay body
- Bs sieves
- Receiver and trough
- Crusher
- Internet

## TDCR 214: Ceramics and Concrete Works

Duration: 60 Hours

### Module Overview

This module equips the learner with the knowledge about the materials, manufacture and vast application of concrete in construction industry.

### Learning Outcome

By the end of this module, the learner should be able to design and manufacture ceramic concrete products to client's satisfaction.

### Preparatory Assignment

Prior to teaching this module, guide the learner to visit the nearby building sites to observe various materials and techniques applied in mixing concrete.

### Results

The learner visits sites, carries out the observation, asks questions and discusses the findings in groups in the class.

## Sub-module 1: Introduction

Duration: 4 Hours

Competences	Content	Teaching Strategies
The learner describes the types and properties of concrete in fresh state and hardened state.	<ul style="list-style-type: none"> <li>Basics of concrete technology</li> <li>Properties of concrete, types of concrete and their applicability: plain concrete, reinforced concrete, pre-cast concrete, pre-stressed concrete</li> </ul>	<ul style="list-style-type: none"> <li>Show a documentary on production and placing of concrete.</li> <li>Lead a guided discussion on properties of concrete in hardened and fresh state.</li> <li>Take the learner to the sites; ask the foreman to explain application and demonstrate process of manufacturing different types of concrete. Task learners to discuss the site findings, write a report and present in groups.</li> </ul>



## Assessment Strategies

The learner:

- discusses the site findings, writes a report and presents in groups to the class.
- does class work on types of concrete and their applicability.

## Resources

- Flip charts
- Relevant text
- On-line sources
- Documentary

## Sub-module 2: Materials for Concrete

Duration: 10 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• selects concrete materials.</li> <li>• describes types of aggregates.</li> <li>• grades aggregates.</li> <li>• stores aggregates.</li> <li>• carries tests for aggregates.</li> </ul>	<ul style="list-style-type: none"> <li>• Choice and quality of aggregates:</li> <li>• Type of aggregates; natural artificial, normal weight and light weight</li> <li>• Production of aggregates, grading of aggregates.</li> <li>• Bulking of sand and its effects on batching</li> <li>• Storing of aggregates, tests for aggregates: cleanliness, grading, organic impurities, strength</li> </ul>	<ul style="list-style-type: none"> <li>• Display various aggregate types.</li> <li>• Lead a guided discussion on choice, and qualities of aggregates.</li> <li>• Take the learner to the quarry sites; ask the quarry manager to explain grading and demonstrate process of crushing aggregates. Task learner to discuss the site findings, write a report and present in groups.</li> <li>• Take the learner to material testing laboratory for the learners to observe testing of aggregates.</li> </ul>

**Assessment Strategies**

The learner:

- discusses the site findings, writes a report and presents in groups to the class.
- does test on shapes, types and grading of aggregates.
- writes assignment on properties of aggregates, storage of aggregates and reasons for using aggregates in concrete.

**Resources**

- Flip charts
- Relevant text
- On-line sources
- Documentary
- aggregates

## Sub-module 3: Water and Concrete Mix Design

### Water and Concrete Mix Design

Duration: 6 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>• identifies source of clean water for concrete.</li> <li>• tests the qualities of water for mixing concrete.</li> <li>• designs concrete mixes.</li> <li>• produces concrete cubes for testing.</li> </ul>	<ul style="list-style-type: none"> <li>• Suitability of water for concrete</li> <li>• Tests for water to use for concrete</li> <li>• Water cement ratio</li> <li>• Aggregate cement ratio</li> <li>• Workability</li> <li>• Concrete mix design</li> <li>• Trial mixes</li> <li>• Yield of a concrete mix; quantities required to produce a cubic meter of concrete, allowance for wastage</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on qualities of water for mixing concrete and its source.</li> <li>• demonstrate workability tests.</li> <li>• Show a documentary on production and placing of concrete.</li> <li>• Illustrate the design of concrete mixes.</li> <li>• Demonstrate process of casting concrete cubes.</li> <li>• Task the learner to produce concrete cubes in groups.</li> </ul>

## Assessment Strategy

The learner carries out the slump and compaction factor tests on concrete.

## Resources

- Flip charts
- Relevant text
- On-line sources
- Documentary
- Slump apparatus
- Aggregate, water, cement

## Sub-module 4: Formwork

Duration: 8 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• designs formwork and moulds.</li> <li>• carries out formwork shuttering and striking.</li> <li>• describes and observes the requirements for formwork.</li> <li>• applies mould oils and retarders.</li> </ul>	<ul style="list-style-type: none"> <li>• Preparation of formwork</li> <li>• Design of formwork for slabs, beams, columns/ walls, consideration of hydrostatic pressures</li> <li>• Types and use of mould oils and retarders</li> <li>• Removal of formwork</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on reasons for applying mould oils and requirements for formwork.</li> <li>• Take the learners to the sites and ask the foreman to explain and demonstrate formwork shuttering and striking.</li> <li>• Task the learner to discuss the site findings, write a report and present in groups.</li> <li>• Guide in application of mould oils and retarders.</li> </ul>

## Assessment Strategies

The learner:

- discusses the site findings, writes a report and presents in groups to the class.
- demonstrates the making of formwork for beams, columns, slabs.

**Resources**

- Flip charts
- Relevant textbooks
- On-line sources
- Documentary
- Timber
- Measuring tapes
- Mould oils
- Nails
- Saws

**Sub-module 5: Concreting Process**

Duration: 16 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>• batches concrete by weight and volume.</li> <li>• mixes concrete by hand and machine.</li> <li>• transports and places concrete.</li> <li>• compacts concrete using vibrators and hand rammers.</li> <li>• provides joints to concrete.</li> <li>• applies surface, finishes and cures concrete for at least 21 days.</li> </ul>	<ul style="list-style-type: none"> <li>• Batching by volume and by weight (advantages and disadvantages of each)</li> <li>• Mixing : machine and hand mixing, site and already mixed concrete, advantages and disadvantages of each</li> <li>• Transporting concrete: wheelbarrow, dumpers, tipping lorries, hoists, chutes, truck mixers, agitators, pumps</li> <li>• Placement of concrete: in foundations, columns, beams, upper floor slabs, paving and roads, tools and equipments used</li> <li>• Compaction of concrete; by hand, internal and external vibrators, time required for compaction, effects of over compaction, and under compaction, bleeding, honey combing</li> <li>• Preparation of Joints: basic considerations, removing laitance, making horizontal and vertical joints, for hand compacted and vibrated concrete</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate batching by volume and weight.</li> <li>• Demonstrate hand, machine mixing, transporting, placing, compacting, provision of joints, and curing of concrete.</li> <li>• Guide curing of concrete; reasons for curing, methods of curing and protection of columns, beams, walls, floors, roads; when to start and how long to cure.</li> </ul>

Competences	Content	Teaching Strategies
	<ul style="list-style-type: none"> <li>• Curing of concrete: reasons for curing, methods of curing and protection of columns, beams, walls, floors, roads; when to start and how long to cure.</li> <li>• Surface finishing.: exposed surfaces, bolt holes, fins and curtains, patching</li> </ul>	

### Assessment Strategies

The learner:

- batches materials.
- places concrete, compact using vibrators.
- discusses methods of transporting concrete.
- does classwork on reasons and methods of curing concrete.

### Resources

- Flip charts
- Relevant textbooks
- On-line sources
- Documentary
- cube boxes
- poker vibrator
- spades
- aggregate
- cement
- mixer
- water

## Sub-module 6: Protecting Concrete during Casting

Duration: 8 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• covers and protects concrete from</li> </ul>	<ul style="list-style-type: none"> <li>• Concreting in hot weather: precautions when transporting, placing and compacting, protection from</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on factors to observe when concreting in</li> </ul>

Competences	Content	Teaching Strategies
premature drying before hardening in hot weather. <ul style="list-style-type: none"><li>• covers and protects concrete from excess water and frost in cold weather.</li></ul>	dry winds and heat from the sun <ul style="list-style-type: none"><li>• Concrete in cold weather; protection from freezing and frost</li><li>• Concreting in wet conditions; protection from rain and running water</li><li>• Protection against shrinkage, cracking and creep.</li><li>• Protection for mass concrete</li></ul>	hot and cold weather and protection of concrete.

### Assessment Strategy

The learner does classwork on protection of concrete from freezing, shrinkage and creep.

### Resources

- Flip charts
- Relevant textbooks
- On-line sources
- Documentary

## Sub-module 7: Pre-cast Concrete and Products

Duration: 8 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>discusses advantages of pre-cast concrete over cast-in-situ</li> <li>stores the products.</li> <li>produces precast concrete products.</li> </ul>	<ul style="list-style-type: none"> <li>Advantages and disadvantages of pre-cast concrete</li> <li>Handling and storage on site</li> <li>Manufacture of precast pavers, culverts, balustrades, columns, slabs, fencing poles, flower containers, decorative features, copings, monuments, tiles</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on advantages and disadvantages of pre-cast concrete over cast in-situ.</li> <li>demonstrate manufacture of precast pavers, culverts, balustrades, columns, slabs, fencing poles, flower containers, decorative features, copings, monuments, tiles.</li> </ul>

### Assessment Strategy

The learner produces pre-cast pavers, culverts, balustrades, fencing poles, flower container and monuments.

### Resources

- Flip charts
- Relevant text
- On-line sources
- Documentary
- Aggregate
- Cement
- Moulds
- Poker vibrator
- Mould oils

## TDCR 215: Real Life Project III

Duration: 60 Hours

### Module Overview

This module equips the learner with the skills and techniques applied in the preparation, throwing, filter pressing, mould making and biscuit firing of ceramic products.

### Learning Outcome

By the end of this module, the learner should be able to filter presses and plaster the mould to produce articles.

### Preparatory Assignment

Before teaching this module, take the learner to studios where slip casting methods are practised, task learners to observe the operations and the skills used in the production process.

### Results

The learner observes the operations and takes note of the skills applied in the production, discusses the processes, writes a report and makes a group presentation.

### Sub-Module1: Body Preparation for Filter Pressing

Duration: 16 Hours

Competences	Content	Teaching Strategies
<p><b>The learner:</b></p> <ul style="list-style-type: none"> <li>• sorts out the materials.</li> <li>• crushes the materials.</li> <li>• soaks the clay in troughs.</li> <li>• sieves the clay slip.</li> <li>• feeds the slip on to filter press.</li> <li>• filters press.</li> <li>• removes filter cakes.</li> <li>• kneads the</li> </ul>	<ul style="list-style-type: none"> <li>• Ferrying materials from storage place</li> <li>• Sorting of material.</li> <li>• Preliminary crushing of materials</li> <li>• Soaking of clay in troughs</li> <li>• Blunging of clay</li> <li>• Sieving of clay slip.</li> <li>• Feeding of slip on to filter press</li> <li>• Filter pressing</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided tour of clay factory for the learners to observe the process of plastic clay preparation using filter press, task learners to take notes and write a report and present in class.</li> <li>• Lead a guided discussion on plastic clay preparation by use of filter press.</li> <li>• Demonstrate the production of plastic clay by using filter press and ask the learners to reproduce by carrying out</li> </ul>



Competences	Content	Teaching Strategies
plastic clay.	<ul style="list-style-type: none"> <li>Removal of filter cakes</li> <li>Kneading of plastic clay</li> </ul>	a return demonstration.

### Assessment Strategy

The learner practically prepares clay to its plasticity by help of filter press.

### Resources

- Clay
- Crusher
- Troughs
- Blunger
- Sieves
- Filter press
- Water
- PowerPoint
- Documentaries
- Charts

## Sub-module 2: Throwing

Duration: 10 Hours

Competences	Content	Teaching strategies
The learner: <ul style="list-style-type: none"> <li>prepares clay balls.</li> <li>centres the balls for coffee pots ,tea pots, milk jars ,casseroles.</li> <li>pulls the centred balls into cylinders.</li> <li>shapes the cylinders into desired shapes.</li> <li>removes the shaped article from the potter's wheel to the damp room.</li> </ul>	<ul style="list-style-type: none"> <li>Coffee pots</li> <li>Teapots.</li> <li>Milk jars.</li> <li>Casseroles</li> <li>Water coolers</li> <li>Sugar bowls</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided tour of a ceramic workshop or pottery studio to observe the skills and techniques of throwing ceramic products.</li> <li>Demonstrate production of complex shapes using potter's wheel.</li> </ul>

### Assessment Strategies

The learner practically throws ceramic products and produces complex shapes by use of potter's wheel.

**Resources**

- Plastic clay
- Working bench
- Water
- Sponge
- Cutting wire
- Shaping tools
- Trimming tools
- Drawing instruments
- Potter's wheel
- Power point
- Pottery by Petty
- Internet
- charts

**Sub-module 3: Preparation of Casting Slip**

Duration: 12 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>• dries the filter cakes.</li> <li>• batches the cakes.</li> <li>• prepares kaolin, feldspar and weighs.</li> <li>• feeds the materials into the blunger.</li> <li>• blunges the material into slip.</li> <li>• makes required casting slip.</li> </ul>	<ul style="list-style-type: none"> <li>• Drying of filter cakes of ball clay</li> <li>• Proportioning the cakes and weighing</li> <li>• Preparing kaolin, feldspar and weighing</li> <li>• Feeding dry clay, feldspar and kaolin into the blunger</li> <li>• Addition of water and blunging materials into slip</li> <li>• Addition of sodium silicate to make casting slip</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided tour of a ceramic workshop or pottery studio for the learner to observe preparation of casting slip and the techniques applied in the process.</li> <li>• Demonstrate preparation of casting slip.</li> </ul>

**Assessment Strategies**

The learner prepares casting slip.

**Resources**

- Raw materials
- Water
- Blunger
- Weighing scale
- Working bench
- Container
- PowerPoint
- Textbooks
- Charts
- Clay sample

## Sub-module 4: Slip and Hard Casting

Duration: 12 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• sieves clay slip and prepares plaster moulds.</li> <li>• pours slip into the mould.</li> <li>• empties excess slip after cast formation.</li> <li>• removes cast articles.</li> <li>• dries the articles.</li> </ul>	<ul style="list-style-type: none"> <li>• Sieving of clay slip</li> <li>• Preparing of plaster moulds</li> <li>• Pouring of slip into moulds.</li> <li>• Emptying of excess slip after cast has formed</li> <li>• Removal of cast articles when leather hard</li> <li>• Fettling of the article</li> <li>• Drying of the article</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided tour of a ceramic work shop or pottery studio for the learner to observe slip casting process.</li> <li>• Demonstrate practically the slip casting skills and techniques .</li> </ul>

### Assessment Strategies

The learner practically carries out slip casting.

### Resources

- Casting slip
- Sieve
- Working mould
- Working bench
- Container
- Fettling knife
- Documentaries
- Charts

## Sub-module 5: Biscuit Firing

Duration: 10 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>• cleans all thrown and cast articles.</li> <li>• takes articles to kiln room.</li> <li>• loads and sets kiln on.</li> <li>• allows kiln to cool after firing and offloads kiln.</li> <li>• sorts, grades and packs articles for sale or glost firing.</li> </ul>	<ul style="list-style-type: none"> <li>• Cleaning the articles</li> <li>• Loading the kiln</li> <li>• Setting kiln temperature and time</li> <li>• Offloading the kiln</li> <li>• Sorting the fired articles according to their grades</li> <li>• Parking the graded articles for sale</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided tour of the ceramic factory , workshop or pottery studio for the learner to observe biscuit firing process.</li> <li>• Demonstrate practically the biscuit firing process.</li> <li>• Give a practical on biscuit firing.</li> </ul>

### Assessment Strategies

The learner practically carries out biscuit firing.

### Resources

- Dry articles
- Kiln
- Fuel
- Charts
- Internet

## Description of Year 2 Semester 2

Code	Module Title (All Core Modules)	L	P	CH	CU
<b>TDCH</b> 221	Kiswahili	30	30	45	3
<b>TDCH</b> 222	Entrepreneurship Skills	30	30	45	3
<b>TDCR</b> 221	Ceramics Technology IV	30	30	45	3
<b>TDCR</b> 222	Ceramics Chemistry II	30	30	45	3
<b>TDCR</b> 223	Glass and Technology	30	30	45	3
<b>TDCR</b> 224	Foundry	30	30	45	3
<b>TDME</b> 227	Industrial Organisation and Management	45	0	45	3
<b>TDCR</b> 227	Real Life Project IV	0	120	60	4
<b>Total</b>					<b>25</b>
<b>Semester Load = 25</b>					
<b>Industrial Training Period (Core Module)</b>					
Code	Module Title	L	P	CH	CU
<b>TDCR</b> 231	Industrial Training II	0	360	45	3
<b>Total Year 2 Credits = 55</b>					

## TDCH 221: Kiswahili

### Year 2 Semester 1

Duration: 60 Hours

#### Module Overview

This Module enriches the learner with the basic Kiswahili used by public, builders on construction sites and industries.

#### Learning Outcome

By the end of this module, the learner should be able to communicate in Kiswahili verbally and in a written form.

#### Preparatory Assignment

Task learners in groups to write the name of tools, equipment and materials like a brick trowel, line and pines, spirit level, a plum bob, building sand, aggregates, a hoe, a wheelbarrow, head pans and timber.

#### Result

The learner searches for solutions, writes the interpretations on the list and presents in class.

### Sub-module 1: Introduction

Duration: 6 Hours

Competences	Content	Teaching Strategies
The learner greets with respect the different age groups in Kiswahili.	<ul style="list-style-type: none"> <li>• Origin of Kiswahili,</li> <li>• Widespread and usage,</li> <li>• Greetings to different groups/people</li> </ul>	<ul style="list-style-type: none"> <li>• Guide discussions on the origin and widespread usage of Kiswahili.</li> <li>• Demonstrate how to greet age groups or people in Kiswahili.</li> <li>• Emphasise the common words applied in the greeting.</li> </ul>

#### Assessment Strategy

The learner greets different age groups or people in Kiswahili.

### Resources

- English – Kiswahili hand book
- Kamusi ya Kiswahili sanifu na tuki
- Kamusi ya kingereza Kiswahili tuki

## Sub-module 2: Polite Language

Duration: 6 Hours

Competences	Content	Teaching Strategies
The learner appreciates and asks for direction or any assistance in Kiswahili.	<ul style="list-style-type: none"> <li>• Greetings to elders, youth and peers</li> <li>• Salutations at different durations of the day</li> <li>• Appreciation and saying thank you for work done, gifts given</li> <li>• Asking for directions, assistance, food</li> </ul>	<ul style="list-style-type: none"> <li>• Guide learners in the words used when conversing and making a phone call in Kiswahili.</li> <li>• Guide learners into a quiz in Kiswahili</li> </ul>

### Assessment Strategies

Task the learner to write simple greetings for elders, peers and public in Kiswahili.

### Resources

- English – Kiswahili hand book
- Kiswahili-English dictionary

## Sub-module 3: General Vocabulary

Duration: 12 Hours

Competences	Content	Teaching Strategies
The learner uses the common Kiswahili vocabularies in hotels, roads and other situations.	<ul style="list-style-type: none"> <li>• Common usage of Kiswahili</li> <li>• Counting in Kiswahili</li> <li>• Common mistakes to be avoided</li> </ul>	<ul style="list-style-type: none"> <li>• Guide the learner through debates on the usage of the common Kiswahili vocabulary applied in restaurants, hospitals, markets and at the office.</li> <li>• Demonstrate the counting of numbers in Kiswahili, dates, days and births.</li> <li>• Emphasise the counting of cash.</li> </ul>

**Assessment Strategy**

The learner counts and mentions his/her date of birth in Kiswahili.

**Resources**

- English – Kiswahili hand book
- Kiswahili- English Dictionary

## Sub-module 4: Specific Trade (professional related) Vocabulary

Duration: 10 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>• names tools and materials used in their professions.</li> <li>• describes the titles of officers in engineering industry and the tasks performed in their professions.</li> </ul>	<ul style="list-style-type: none"> <li>• Names of tools used in their respective trades.</li> <li>• Tasks performed in engineering industry</li> <li>• Titles of Officers in engineering industry; for example engineers, plumbers, surveyors, technicians, managers, foremen, craftsmen etc</li> <li>• Names of materials used in their respective trade for example; sand, pipes, cables, cement etc</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on the names of tools, materials, tasks and titles used in the profession/ trade.</li> </ul>

**Assessment Strategy**

The learner names the tools and common materials used in water and other construction works in Kiswahili.

**Resources**

- English – Kiswahili hand book
- Kiswahili- English Dictionary



## Sub-module 5: Customer Care and Language

Duration: 10 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>welcomes and thanks customers in Kiswahili.</li> <li>writes announcements and advertises products in Kiswahili.</li> </ul>	<ul style="list-style-type: none"> <li>Attitude to customers, public relations and advertising of products</li> <li>Handling customers: welcoming them, asking whether they need help, thanking them</li> </ul>	<ul style="list-style-type: none"> <li>Demonstration on how to welcome and thank customers in Kiswahili, emphasising words used for humility and persuasion.</li> <li>Illustrate the style of writing an announcement and the suitable words used.</li> </ul>

### Assessment Strategies

The learner:

- welcomes customers into the business in Kiswahili.
- does classwork on announcements, and advertises products in Kiswahili.

## Sub-module 6: Presentations in Kiswahili

Duration: 10 Hours

Competences	Content	Teaching Strategies
The learner markets and sells goods and services in Kiswahili.	<ul style="list-style-type: none"> <li>Marketing and selling water, plumbing and building engineering materials and goods</li> </ul>	<ul style="list-style-type: none"> <li>Demonstrate the marketing and selling of water and plumbing materials and goods.</li> <li>Outline the common words applied when marketing products and convincing customers.</li> </ul>

### **Assessment Strategy**

The learner makes a presentation on marketing in Kiswahili.

### **Resources**

- English – Kiswahili hand book
- Kiswahili- English Dictionary

## TDCH 222: Entrepreneurship Skills

Duration: 60 Hours

### Module Overview

This module equips the learner with the basic entrepreneurship skills of starting and running up an enterprise.

### Learning Outcome

By the end of the module, the learner should be able to create a job by starting up and managing an enterprise.

### Preparatory Assignment

Ask the learner to think of an innovative business idea and write a simple business plan to indicate the requirements and how the business will be operated.

### Results

The learner writes down his/her business ideas, all the perceptions and presents the process to the class.

## Sub-module 1: Entrepreneurship Development

Duration: 6 Hours

Competences	Content	Teaching Strategies
The learner applies the characteristics of an entrepreneur in business and sets the future goals.	<ul style="list-style-type: none"> <li>• Concepts and definitions</li> <li>• Entrepreneurship objectives and aspects</li> <li>• Historical context</li> <li>• Focus on why entrepreneurship education</li> </ul>	<ul style="list-style-type: none"> <li>• Introduce entrepreneurship by giving the definition and share with learners why it is important to study entrepreneurship.</li> <li>• Lead a guided discussion on the historical context and ask the learner to share his/her experiences in the business world with the class.</li> </ul>

### Assessment Strategy

The learner shares his/her experience and sets future goals as entrepreneur to be.

**Resources**

- Textbooks
- Internet
- Journals
- Newspapers
- Entrepreneurship for today

**Sub-module 2: Uganda's Experience**

Duration: 6 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• compares the Ugandan entrepreneurship experience with that of other countries.</li> <li>• describes the current trends in business growth.</li> <li>• identifies barriers to entrepreneurship development in relation to the current trends in entrepreneurial development.</li> </ul>	<ul style="list-style-type: none"> <li>• Comparison with other countries</li> <li>• Current trends in business growth</li> <li>• Barriers to entrepreneurship development</li> </ul>	<ul style="list-style-type: none"> <li>• Guide the learner in comparing the entrepreneur development of Uganda to other countries.</li> <li>• Organise a seminar and invite an entrepreneur to discuss the entrepreneurship developments and ventures to the learner.</li> <li>• Guide the learner in identifying the current trends in various fields of business.</li> <li>• Lead a guided discussion on barriers to entrepreneurship development</li> </ul>

**Assessment Strategies**

The learner:

- identifies the barriers and their solutions to entrepreneurial process.
- does homework on current trends in business growth.

**Resources**

- Newspaper articles on business and entrepreneurship
- Internet resources on entrepreneurship
- Entrepreneurship seminar articles

## Sub-module 3: Entrepreneurship Process

Duration: 10 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>suggests and illustrates the entrepreneurial process for a business.</li> <li>describes characteristics of entrepreneurship.</li> <li>surveys the market for the business ideas, and spots business opportunities and tests them.</li> </ul>	<ul style="list-style-type: none"> <li>Entrepreneurship phases/cycle</li> <li>Characteristics of entrepreneurship</li> <li>Spotting business opportunities</li> <li>Assembling of essential resources</li> <li>Carrying on market survey</li> <li>Writing a business plan</li> </ul>	<ul style="list-style-type: none"> <li>Display charts for entrepreneurship process and illustrate to the learner the entrepreneurial processes.</li> <li>Lead a guided discussion on the characteristics of entrepreneurship, and on an entrepreneur.</li> <li>Demonstrate some of the techniques for business opportunity recognition.</li> </ul>

### Assessment Strategies

The learner:

- identifies some of the areas for business opportunities and analyses what it requires for a business to stand the test.
- does homework on characteristics of entrepreneurship.

### Resources

- Charts for entrepreneurial process.
- Flip charts, textbooks on entrepreneurship.
- Internet resources.

## Sub-module 4: Employment Creation

Duration: 10 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>lobbies for capital, other resources and starts an</li> </ul>	<ul style="list-style-type: none"> <li>Self-employment.</li> <li>Employment and business policies.</li> <li>Programmes for</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on sources of capital for new businesses.</li> </ul>

Competences	Content	Teaching Strategies
enterprise. <ul style="list-style-type: none"> <li>appreciates employment policies, registers a business and pays taxes.</li> </ul>	development. <ul style="list-style-type: none"> <li>Types of businesses; legal forms of business;</li> <li>Business registration procedures</li> <li>Intellectual property and business innovation</li> <li>Sources of capital for start-ups</li> </ul>	<ul style="list-style-type: none"> <li>Illustrate some of the techniques employed for development in self-employment.</li> <li>Illustrate to the learner how to register a business.</li> <li>Lead a guided discussion on the legal forms of businesses.</li> <li>Discuss the employment policies.</li> </ul>

### Assessment Strategy

The learner identifies the sources of capital for new businesses and the possible ways of tapping such resources.

### Resources

- Business articles on sources of capital.
- Government's Employment Acts.
- Company registration acts and laws.
- Sample registration certificates and licenses.
- Internet resources on entrepreneurial business innovation.

## Sub-module 5: Marking New Ventures

Duration: 10 Hours

Competence(s)	Content	Teaching Strategies
The learner carries out SWOT analysis for a business and develops the marketing plans.	<ul style="list-style-type: none"> <li>Marketing approaches</li> <li>Developing marketing plan</li> <li>Strengths, weaknesses, opportunities and threats (SWOT) analysis</li> </ul>	<ul style="list-style-type: none"> <li>Give the learner sample business plans to review; and lead a guided discussion and illustrate on board on how to write the business plan.</li> <li>Illustrate some of the management techniques in business.</li> <li>Demonstrate to the</li> </ul>

Competence(s)	Content	Teaching Strategies
		learner how to communicate in business environment.

### Assessment Strategy

The learner carries out SWOT analysis on sample businesses and develops market plans.

### Resources

- Sample market plans
- Relevant entrepreneurship textbooks on this topics
- Internet materials on SWOT
- Business documentations

## Sub-module 6: Managing a Business Enterprise

Duration: 8 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• starts and manages the business effectively.</li> <li>• runs advertisement for the business.</li> </ul>	<ul style="list-style-type: none"> <li>• Strategic management</li> <li>• Communication in business</li> <li>• Building success in an enterprise</li> <li>• How the business can fail</li> <li>• How to prevent business failure</li> <li>• How to attract customers</li> <li>• Saving and reinvestment</li> <li>• Business relationship with family and friends</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on business management.</li> <li>• Illustrate to the learner factors that lead to business failures.</li> <li>• Demonstrate to the learner how advertisements can be carried out to attract new clients to the business.</li> </ul>

### Assessment Strategies

The learner:

- prepares the advertisement that attracts new clients to the business.
- does homework on how to prevent business failure.

**Resources**

- Relevant entrepreneurship textbooks on this topic
- Business documentations
- Sample business adverts.

## Sub-module 7: Financial Management and Cost Accounting Systems

Duration: 10 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>• carries out the cost analysis of an enterprise.</li> <li>• manages the accounting books of the business.</li> <li>• describes effects of taxation on economic growth.</li> </ul>	<ul style="list-style-type: none"> <li>• Cost analysis and control; methods of cost control</li> <li>• Accounting; managing business account books. purpose of record keeping, role accounting statements, basic accounting methods (cash and accrual)</li> <li>• Taxation; effects of taxation on economic growth, role of taxes, knowing taxes to pay</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on cost analysis and control in business.</li> <li>• Mention the types of the books of accounts used in business and demonstrate how these books can be managed and maintained.</li> <li>• Lead a guided discussion on business taxes and illustrate their effects on business</li> </ul>

**Assessment Strategies**

The learner:

- develops sample books of accounts commonly applied to enterprises.
- does class work on effects of taxation on economic growth.

**Resources**

- Taxation acts
- Sample books of accounts like cash book and ledger
- Relevant articles and textbooks on taxation, financial management



## NDCR 221: Ceramic Technology IV

Duration: 60 Hours

### Module Overview

This module enriches the learner with skills of enamel glazing, ceramic decorative processes, heavy ware production and refractories.

### Learning Outcome

By the end of the module, the learner should be able to apply enamel coats and other glazes on ceramic products.

### Preparatory Assignment

Before teaching this module, take the learner to factories that produce tiles, bricks, flower pots, decorative grills and other building materials and task the learner to keenly observe the heavy ware ceramic production and the equipment used.

### Result

The learner observes, takes note of the heavy ware production processes, writes a report and makes a presentation.

## Sub-module 1: Introduction to Enamels on Metals

Duration: 7 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>applies low-fusing glazes on wares.</li> <li>describes theories of adherence and methods of obtaining opacity.</li> <li>applies various techniques and methods of obtaining opacity.</li> <li>applies enamel in glazing jewel, sheet steel, aluminium and refractory.</li> <li>develops enamels.</li> </ul>	<ul style="list-style-type: none"> <li>Low-fusing glaze.</li> <li>Theories of adherence</li> <li>Methods of obtaining opacity</li> <li>Jewellery enamel.</li> <li>Enamels for sheet steel</li> <li>Cast iron enamels</li> <li>Enamels for aluminium</li> </ul>	<ul style="list-style-type: none"> <li>Show a documentary on glazing metals using enamel.</li> <li>Guide a discussion on low-fusing glazes.</li> <li>Practically demonstrate the methods of enamelling ceramic products.</li> <li>Guide the learner during</li> </ul>

Competences	Content	Teaching Strategies
	<ul style="list-style-type: none"> <li>Refractory enamels</li> <li>Development of enamels</li> </ul>	brainstorming session on enamel development.

### Assessment Strategies

The learner practically carries out enamelling of ceramic products like sheets.

### Resources

- Flip charts
- Relevant textbooks
- On-line sources
- Documentary
- Metal articles glazed with enamel

## Sub-module 2: Introduction to Decorative Processes

Duration: 8 Hours

Competences	Content	Teaching Strategies
<p><b>The learner</b></p> <ul style="list-style-type: none"> <li>prepares colloidal colours and use them to decorate a ceramic article.</li> <li>uses the response of colour of an article to sunshine in design of ceramic articles.</li> <li>uses stains in colouring a ceramic.</li> </ul>	<ul style="list-style-type: none"> <li>Colloidal colours</li> <li>Colour in crystals</li> <li>Ceramic stains</li> <li>Luster</li> <li>Gilding</li> </ul>	<ul style="list-style-type: none"> <li>Guide a discussion on colloidal colour, Colour in crystals, luster, Gilding and ceramic stains.</li> <li>Demonstrate decorating processes using colloidal colours.</li> <li>Show a documentary on decorating processes and task the learner to make notes.</li> </ul>

### Assessment Strategies

The learner practically decorates ceramic products using colloidal colours.

## Resources

- Flip charts
- Relevant textbooks
- On-line sources
- Documentary
- Samples of ceramic stains and colours

## Sub-module 3: Glazes

Duration: 10 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• differentiates between salt glazes and crystalline glazes.</li> <li>• describes the influence of glazes on the mechanical strength of ceramics bodies.</li> </ul>	<ul style="list-style-type: none"> <li>• Salt glaze and crystalline glaze</li> <li>• Lead glazes and leadless glazes</li> <li>• Opaque glazes and matt glazes</li> <li>• Influence of glazes on the mechanical strength of ceramics bodies</li> </ul>	<ul style="list-style-type: none"> <li>• Show the learner the samples of articles coated with different types of glazes.</li> <li>• Lead a guided discussion on the similarities and differences between lead glazes and leadless glazes, salt glazes and crystalline glazes, opaque glazes and transparent glaze, emphasising on glaze application.</li> <li>• Guide the learner to brainstorm the influence of glazes on the mechanical strength of ceramics bodies.</li> </ul>

## Assessment Strategies

The learner:

- applies glazes on ceramic made items.
- does test on glazes.

## Resources

- Flip charts
- On-line sources

## Sub-module 4: Practical Application of Glazes

Duration: 15 Hours

Competences	Content	Teaching Strategies
<p><b>The learner:</b></p> <ul style="list-style-type: none"> <li>demonstrates the process of applying commercial glaze on an article</li> <li>uses the dip and spray methods while glazing</li> <li>applies glaze to ceramic items</li> </ul>	<ul style="list-style-type: none"> <li>For commercial glazes:           <ul style="list-style-type: none"> <li>weigh the required amount according to capacity of ball mill</li> <li>mix with correct capacity of water</li> <li>mill mix after adding tiny proportion of kaolin</li> <li>remove slip and sieve with very fine mesh in buckets.</li> <li>clean biscuit fired articles</li> <li>dip article into glaze mix or spray as method may apply</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on the process of applying commercial glaze on an article.</li> <li>Demonstrate the dip and spray methods while glazing an article.</li> </ul>

### Assessment Strategies

The learner applies glazes on articles by dipping and spraying.

### Resources

- Flip charts
- Relevant textbooks
- On-line sources
- Commercial glaze
- Mixing bucket

## Sub-module 5: Practical Glost Firing

Duration: 20 Hours

Competences	Content	Teaching Strategies
<p><b>The learner:</b></p> <ul style="list-style-type: none"> <li>• sets kiln to the required temperature.</li> <li>• takes care during the offloading of articles from the kiln.</li> <li>• grades articles.</li> </ul>	<ul style="list-style-type: none"> <li>• Load glazed article into kiln</li> <li>• Set kiln to the required temperature and time</li> <li>• Allow kiln to cool</li> <li>• Off-load the kiln</li> <li>• Sort out the articles according to grades for sale</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate the techniques of loading glazed articles into the kiln, setting out the kiln to the required temperature and time, firing, allowing the kiln to cool and off-loading the kiln.</li> <li>• Guide the learner through the sorting out of the articles according to grades for sale.</li> </ul>

### Assessment Strategies

The learner practically loads glazed articles into the kiln, sets out the kiln to the required temperature and time, fires, allows the kiln to cool and offloads the kiln.

### Resources

- Flip charts
- Relevant textbooks
- On-line sources
- Commercial glaze
- Mixing bucket

## TDCR 222: Ceramic Chemistry II

Duration: 60 Hours

### Module Overview

This module exposes the learner to the significance and role of Chemistry in the development of modern technology.

### Learning Outcome

By the end of this module, the learner should be able to apply the scientific methods of production and use of materials.

### Preparatory Assignment

Prior to teaching this module, use guided questions to allow the learner to brainstorm ideas on terms and units of measurements used in the study of Chemistry and chemical reactions.

### Results

The learner presents his/her findings.

## Sub-module 1: Introduction and Fundamental Concepts

Duration: 2 Hours

Competences	Content	Teaching Strategies
The learner describes the terms used and units of measurement in the study of Chemistry.	<ul style="list-style-type: none"><li>• Orientation with reference to this technology</li><li>• Terms used and units of measurement in the study of Chemistry</li><li>• Chemical reactions and their types</li></ul>	Lead a guided discussion on the terms used and units of measurement in the study of Chemistry, chemical reactions and their types.

### Assessment Strategy

The learner does on the terms used and units of measurement in the study of Chemistry, chemical reactions and their types.

### Resources

- Flip charts
- Relevant text
- On-line sources
- Documentary

## Sub-module 2: Atomic Structure

Duration: 4 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• analyses the sub-atomic particles, architecture of atoms of elements.</li> <li>• classifies elements periodic law.</li> <li>• illustrates the characteristics of a period and group.</li> </ul>	<ul style="list-style-type: none"> <li>• Sub-atomic particles architecture of atoms of elements</li> <li>• Atomic number and atomic weight</li> <li>• The periodic classification of elements using the periodic law</li> <li>• General characteristics of a period and group</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on sub-atomic particles architecture of atoms of elements, atomic number and atomic weight.</li> <li>• Group the learners to discuss the periodic classification of elements using the periodic law and general characteristics of a period and group.</li> </ul>

### Assessment Strategies

The learner:

- does classwork on the periodic classification of elements using the periodic law and general characteristics of a period and group.
- does assignment on atomic number and atomic weight.

### Resources

- Flip charts
- Relevant textbooks
- On-line sources
- Documentary

## Sub-module 3: Chemical Bond

Duration: 6 Hours

Competences	Content	Teaching Strategies
<p><b>The learner:</b></p> <ul style="list-style-type: none"> <li>describes the nature of chemical bond.</li> <li>investigates the nature of chemical bond.</li> <li>differentiates between electrovalent bond covalent bond and co-ordinate bond.</li> </ul>	<ul style="list-style-type: none"> <li>Nature of chemical bond</li> <li>Electrovalent bond with examples</li> <li>Covalent bond (polar and non-polar, sigma and pie bonds with examples)</li> <li>Co-ordinate bond with examples</li> <li>Electrovalent bond with examples Covalent bond (polar and non-polar, sigma and pie bonds with examples)</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on electrovalent bond, covalent bond and co-ordinate bond.</li> </ul>

### Assessment Strategy

The learner does class work on electrovalent bond, covalent bond and co-ordinate bond.

### Resources

- Flip charts
- Relevant textbooks
- On-line sources
- Documentary



## Sub-module 4: Water

Duration: 6 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>describes chemical nature and properties of water.</li> <li>carries out tests on water including softening of water.</li> <li>describes sewage treatment.</li> </ul>	<ul style="list-style-type: none"> <li>Chemical nature and properties</li> <li>Impurities</li> <li>Hardness of water (types, causes and removal)</li> <li>Scales of measuring hardness (degrees clark French, PPM, Mg- per litre)</li> <li>Boiler feed water, scales and treatment</li> <li>Sea water desalination, sewage treatment</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on sewage treatment and properties of water.</li> <li>demonstrate tests on water.</li> </ul>

### Assessment Strategies

The learner:

- does class work on methods of water softening.
- Searches for solutions on boiler feed water, scales and treatment.

### Resources

- Flip charts
- Relevant textbooks
- On-line sources
- Documentary

## Sub-module 5: Acids, Bases and Salts

Duration: 4 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>differentiates between acids, bases and salts and classifies salts.</li> <li>describes properties, their</li> </ul>	<ul style="list-style-type: none"> <li>Definitions with examples</li> <li>Properties, their strength, basicity and acidity</li> <li>Salts and their</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on properties, their strength, basicity and acidity.</li> </ul>

Competences	Content	Teaching Strategies
strength, basicity and acidity. <ul style="list-style-type: none"> <li>discusses the pH – value and scale, salts and their classification.</li> </ul>	classification with examples pH – value and scale	<ul style="list-style-type: none"> <li>Group the learner to discuss salts and their classification with examples and pH – value and scale.</li> </ul>

### Assessment Strategies

The learner:

- does classwork on properties, their strength, basicity and acidity.
- does homework on salts and their classification with examples.

### Resources

- Flip charts
- Relevant textbooks
- On-line sources
- Documentary

## Sub-module 6: Oxidation and Reduction

Duration: 4 Hours

Competence(s)	Content	Teaching Strategies
The learner describes the oxidation reduction process and classifies oxides .	<ul style="list-style-type: none"> <li>The process, definition and examples</li> <li>Oxidising and reducing agents</li> <li>Oxides and their classifications</li> </ul>	<ul style="list-style-type: none"> <li>Group the learner to discuss the process, definition and examples of oxidising and reducing agents, oxides and their classifications.</li> </ul>

### Assessment Strategies

The learner:

- does classwork on oxidation and reduction process.
- does homework on oxides and their classifications.

### Resources

- Flip charts
- Relevant textbooks

- On-line sources
- Documentary

## Sub-module 7: Nuclear Chemistry

Duration: 4 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• differentiates between alpha, beta and gamma rays.</li> <li>• describes the half life process and nuclear reaction and transformation of elements.</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Radioactivity (alpha, beta and gamma rays)</li> <li>• Half life process</li> <li>• Nuclear reaction and transformation of elements</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on radioactivity (alpha, beta and gamma rays).</li> <li>• Group the learner to discuss half life process, nuclear reaction and transformation of elements.</li> </ul>

### Assessment Strategies

The learner:

- does class work on radioactivity (alpha, beta and gamma rays).
- presents their findings on group discussion.

### Resources

- Flip charts
- Relevant textbooks
- On-line sources
- Documentary

## Sub-module 8: Plastics and Polymers

Duration: 10 Hours

Competences	Content	Teaching Strategies
<p><b>The learner:</b></p> <ul style="list-style-type: none"> <li>classifies plastics, polymers and uses them.</li> <li>describes the manufacturing process of plastics and polymers.</li> <li>uses plastics.</li> </ul>	<ul style="list-style-type: none"> <li>Introduction and importance</li> <li>Classification, and manufacture</li> <li>Properties and uses</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on classification, manufacture of plastics and polymers.</li> <li>Lead a guided tour of the plastic industry for the learner to observe the manufacturing process.</li> <li>Group the learner to discuss properties and uses of plastics and polymers.</li> </ul>

### Assessment Strategies

The learner:

- does class work on classification, manufacture of plastics and polymers.
- presents his/her findings from the industrial visits to the class.

### Resources

- Flip charts
- Relevant textbooks
- On-line sources
- Documentary

## Sub -module 9: Paints, Varnishes and Distemper

Duration: 10 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>classifies paints, varnishes and distempers.</li> <li>applies paints, varnishes</li> </ul>	<ul style="list-style-type: none"> <li>Introduction</li> <li>Constituents</li> <li>Preparation and use</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on classification of paints, varnishes and distempers.</li> <li>Group the learner to discuss constituents of paints and varnishes.</li> <li>Lead a guided tour of the paint factory for the</li> </ul>

Competences	Content	Teaching Strategies
and distempers on surfaces.		learners to observe the manufacturing process. <ul style="list-style-type: none"> <li>• Demonstrate application of paints and varnishes.</li> </ul>

### Assessment Strategies

The learner:

- does classwork on classification of paints, varnishes and distempers and presents their findings in group discussion.
- presents his/her findings from the factory visits.
- makes return demonstration of painting and varnishing.

### Resources

- Flip charts
- Relevant textbooks
- On-line sources
- Documentary
- Paint
- Varnish
- Painting and varnishing brushes

## Sub-module 10: Refractory Materials and Abrasive

Duration: 4 Hours

Competences	Content	Teaching strategies
The learner: <ul style="list-style-type: none"> <li>• classifies refractories.</li> <li>• differentiates between artificial and natural abrasives.</li> <li>• uses artificial and natural abrasives.</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction to refractories</li> <li>• Classification of refractories</li> <li>• Properties and uses</li> <li>• Introduction to abrasives</li> <li>• Artificial and natural abrasives and their uses</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on classification of refractories properties and uses; and introduction to abrasives.</li> <li>• Group the learner to discuss artificial and natural abrasives and their uses.</li> </ul>

**Assessment Strategies**

The learner:

- does classwork on classification, manufacture of plastics and polymers.
- presents findings of the group during discussion.

**Resources**

- Flip charts
- Relevant textbooks
- On-line sources
- Documentary

**Sub-module 11: Fuels and Combustion**

Duration: 4 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• classifies fuels.</li> <li>• describes combustion and numerical problems of combustion.</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction to fuels</li> <li>• Classification of fuels</li> <li>• Combustion</li> <li>• Numerical problems of combustion</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on fuels, combustion and numerical problems of combustion.</li> </ul>

**Assessment Strategy**

The learner does class work on fuels combustion and numerical problems of combustion.

**Resources**

- Flip charts
- Relevant textbooks
- On-line sources
- Documentary

## TDCR 222: Glass Technology

Duration: 60 Hours

### Module Overview

This module gives learner the comprehensive knowledge of raw materials, the composition of glass and effects of various oxides there on.

### Learning Outcome

By the end of this module, the learner should be able to manufacture ceramic glass products.

### Preparatory Assignment

Before teaching this module, take the learner to factories that produce glass products and task him/her to keenly observe the production process.

### Result

The learner observes, takes note of the glass production processes, writes a report and makes a presentation.

## Sub-module 1: Feldspar

Duration: 4 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>describes feldspar mineral and feldspar as a source of alumina.</li> <li>selects the correct materials and proportions for glass making.</li> </ul>	<ul style="list-style-type: none"> <li>Kinds of feldspar mineral; feldspar as a source of alumina; melting temperature of feldspar</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on feldspar mineral as a source of alumina</li> </ul>

### Assessment Strategy

The learner does classwork on feldspar as a source of alumina; and on melting.

### Resources

- Flip charts
- Relevant textbooks

- On-line sources
- Documentary

## Sub-module 2: Glass Sand and Limestone

Duration: 6 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>• describes importance of glass sand and limestone.</li> <li>• sorts out impurities found in the constituent materials used for glass manufacture.</li> </ul>	<ul style="list-style-type: none"> <li>• Importance of glass sand, impurities present in glass sand and forms of</li> <li>• Silica</li> <li>• Importance of limestone, its percentages in glass, availability in Uganda, composition of limestone</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on the importance of glass sand, impurities present in glass sand and forms of silica</li> <li>• Importance of limestone, its percentages in glass.</li> </ul>

### Assessment Strategy

The learner does class work on importance of glass sand, impurities present in glass sand ; and forms of silica ; importance of limestone; its percentages in glass.

### Resources

- Flip charts
- Relevant textbooks
- On-line sources
- Documentary



## Sub-module3: Dolomite and Cryolite

Duration: 6 Hours

Competences	Content	Teaching strategies
The learner: <ul style="list-style-type: none"> <li>identifies chief source of magnesium oxide.</li> <li>uses magnesium oxide for glass manufacture.</li> <li>describes the effect of cryolite on viscosity in glass.</li> </ul>	<ul style="list-style-type: none"> <li>Chief source of Magnesium Oxide (MgO) and its percentage</li> <li>Use of cryolite in glass, its effect on viscosity on glass</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on the constituent materials used for glass.</li> <li>Guide the learner to discuss use of cryolite in glass, its effect on viscosity on glass.</li> </ul>

### Assessment Strategy

The learner does class test on the constituent materials used for glass.

### Resources

- Flip charts
- Relevant textbooks
- On-line sources
- Documentary

## Sub-module 4: Constituent Materials

Duration: 12 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>describes red lead and its use in glass quartz and sandstone, their role and percentage in glass manufacture</li> <li>uses phosphate compounds, zirconium</li> </ul>	<ul style="list-style-type: none"> <li>Red Lead and its use in glass</li> <li>Quartz and Sandstone, their role and percentage in glass manufacture</li> <li>Soda Ash, importance of soda Ash and percentage</li> <li>Decolourizer, colorants, refining agents, cullet</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on the constituent materials used for glass.</li> <li>Group the learner to brainstorm ideas on Phosphate Compounds, Zirconium Calumet and</li> </ul>

Competences	Content	Teaching Strategies
calumet and barium compounds.	<ul style="list-style-type: none"> <li>Phosphate Compounds, Zirconium</li> <li>Calumet and Barium Compounds</li> </ul>	Barium Compounds.

### Assessment Strategy

The learner does class test on the constituent materials used for glass.

### Resources

- Flip charts
- Relevant textbooks
- On-line sources
- Documentary

## Sub-module 5: Potassium Carbonate

Duration: 6 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• identifies Main Source of K<sub>2</sub>O.</li> <li>• manufactures potassium carbonate.</li> <li>• describes the effects of impurities in Potassium Carbonates.</li> </ul>	<ul style="list-style-type: none"> <li>• Potassium Nitrate and Potassium Hydroxide</li> <li>• Main Source of K<sub>2</sub>O, Manufacture of Potassium Carbonate</li> <li>• Impurities in Potassium Carbonates</li> </ul>	<ul style="list-style-type: none"> <li>• Group the learner to brainstorm ideas on main source of K<sub>2</sub>O.</li> <li>• Lead a guided discussion on the manufacture potassium carbonate.</li> <li>• Lead a guided discussion on the impurities in Potassium Carbonates.</li> </ul>

### Assessment Strategies

The learner:

- does classwork on the manufacture of potassium carbonate.
- does homework on impurities in Potassium Carbonates.

### Resources

- Flip charts
- Relevant textbooks
- On-line sources
- Documentary

## Sub-module 6: Composition of Various Glasses

Duration: 10 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>• selects the glass based on its composition.</li> <li>• describes effect of Metallic Oxide, of Iron Oxide, Titanium Oxide, Chromium Oxide Sb<sub>2</sub>O<sub>3</sub>, Cobalt Oxide and Selenium.</li> <li>• does batch calculation.</li> </ul>	<ul style="list-style-type: none"> <li>• Sheet glass, flat glass, plate glass, float glass, neutral glass</li> <li>• Effect of Metallic Oxide, effect of Iron Oxide, effect of Titanium Oxide, effect of Chromium Oxide, effect of Sb<sub>2</sub>O<sub>3</sub>,</li> <li>• PB<sub>2</sub>O<sub>3</sub>, effect of Cobalt Oxide, effect of Selenium,</li> <li>• Batch calculation</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on the composition of glass and where each is applied.</li> <li>• Lead a guided discussion on effect of Metallic Oxide, of Iron Oxide, Titanium Oxide, Chromium Oxide Sb<sub>2</sub>O<sub>3</sub>, Cobalt Oxide and Selenium.</li> <li>• Illustrate batch calculation.</li> </ul>

### Assessment Strategies

The learner:

- does homework on glass composition.
- does class work on batch calculation.

### Resources

- Flip charts
- Relevant textbooks
- On-line sources
- Documentary

## Sub-module 7: Nuclear Chemistry

Duration: 6 Hours

Competences	Content	Teaching Strategies
<p>The learner:</p> <ul style="list-style-type: none"> <li>minimises the effect of radioactive rays on humans.</li> <li>describes half life process, nuclear reaction and transformation of elements.</li> </ul>	<ul style="list-style-type: none"> <li>Introduction</li> <li>Radioactivity (alpha, beta and gamma rays)</li> <li>Half life process</li> <li>Nuclear reaction and transformation of elements</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on transformation of elements and effects of radioactive rays on humans.</li> <li>Show a documentary on the transformation of elements, the processes involved and on the cautions taken care of when handling the radioactive rays.</li> </ul>

### Assessment Strategies

The learner:

- does classwork on use of cryolite in glass, and its effect on viscosity on glass.
- does homework on nuclear reaction and transformation of elements.

### Resources

- Flip charts
- Relevant textbooks
- On-line sources
- Documentary

## Sub-module 8: Preparation of Glass Batch

Duration: 10 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>stores raw materials.</li> <li>removes impurities.</li> <li>weighs and mixes the ingredients for glass manufacture.</li> </ul>	<ul style="list-style-type: none"> <li>Storage of raw materials, removal of impurities, sand washing, screw conveyors, Belt</li> <li>Conveyors, bucket elevators, weighing and mixing, addition of Cullet, conveying to furnace</li> <li>Variable speed motor</li> </ul>	<ul style="list-style-type: none"> <li>Demonstrate storage of raw materials and removal of impurities.</li> <li>Show a documentary on the processes of weighing and mixing the ingredients for glass manufacture.</li> <li>Illustrate the processes of weighing and mixing glass ingredients.</li> </ul>

### Assessment Strategy

The learner does class work on storage of raw materials, removal of impurities, sand washing, screw conveyors, belt.

### Resources

- Flip charts
- Relevant textbooks
- On-line sources
- Documentary

## TDME 227: Industrial Organisation and Management

Duration: 60 Hours

### Module Overview

This module develops the learner's positive attitude on management principles, preliminary factory set up, safety, health and welfare, important factory documents, management of materials, manufacturing plant and equipment, labour management, workshop control, safety and security in industries, welfare in industries, environmental consideration in industries and construction and related laws. The module will equip the learner's with the principles and practices of management in the manufacturing industry.

### Learning Outcome

By the end of this module, the learner should be able to apply the principles and practices of human and materials resource management in the manufacturing industry to maximise production.

### Preparatory Assignment

The learner visits the school workshops and re-designs them in a format that could enhance easy access to tools, materials and utilities and creates safe working conditions.

### Result

The learner presents drawings of his/her workshop designs showing the location of items and safe pathways.

## Sub-module 1: Management Principles

Duration: 2 Hours

Competence(s)	Content	Teaching Strategy
The learner: <ul style="list-style-type: none"> <li>draws the organisation structures.</li> <li>discusses delegation of responsibility and accountability.</li> <li>demonstrates pre-tender planning.</li> </ul>	<ul style="list-style-type: none"> <li>Organisation structure</li> <li>Delegation of responsibility and accountability</li> <li>Pre-tender planning, personnel involvement and objectives</li> </ul>	<ul style="list-style-type: none"> <li>Illustrate how to draw the organisation structure.</li> <li>Lead a guided discussion on description of delegation of responsibility and accountability.</li> <li>Lead a guided discussion on how to carry out pre-tender planning,</li> </ul>

Competence(s)	Content	Teaching Strategy
<ul style="list-style-type: none"> <li>identifies the parties concerned with a company, their functions and interrelationship.</li> </ul>	<ul style="list-style-type: none"> <li>Parties concerned with a company, their functions and interrelationship: client, production and maintenance team (production manager, maintenance engineer, technician, supervisor, mechanic, machinist, plumber, fitter, welder, etc.</li> </ul>	<ul style="list-style-type: none"> <li>personnel involvement and objectives.</li> <li>Demonstrate how to identify the parties concerned with a company, their functions and interrelationship: client, production and maintenance team (production manager, maintenance engineer, technician, supervisor, mechanic, machinist, plumber, fitter, welder, etc.</li> </ul>

### Assessment Strategies

The learner:

- draws the organisation structure.
- describes delegation of responsibility and accountability.
- carries out pre-tender planning, personnel involvement and objectives.
- identifies the parties concerned with a company, their functions and interrelationship: client, production and maintenance team (production manager, maintenance engineer, technician, supervisor, mechanic, machinist, plumber, fitter, welder, etc.

### Resources

- Relevant textbooks
- Documentaries
- Computer and projector
- Flip chart

## Sub-module 2: Preliminary Factory Set-up

Duration: 2 Hours

Competence(s)	Content	Teaching Strategy
<p>The learner:</p> <ul style="list-style-type: none"> <li>• designs workshop layouts, production line layouts.</li> <li>• demonstrates the arrangement of materials access roads.</li> <li>• designs and illustrates the use of factory protection and security systems .</li> <li>• describes temporary services.</li> </ul>	<ul style="list-style-type: none"> <li>• Workshop layout</li> <li>• Production line layout</li> <li>• Storage and material arrangement, access roads</li> <li>• Factory protection and security</li> <li>• Temporary services: water, gas, electricity, telephone, generators, toilets, drainage, kitchen and dining</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate how to design the workshop layout.</li> <li>• Demonstrate how to draw production line layout.</li> <li>• Illustrate how to arrange material access roads.</li> <li>• Demonstrate how to use factory protection and security systems.</li> <li>• Illustrate the description of the temporary services: water, gas, electricity, telephone, generators, toilets, drainage, kitchen and dining.</li> </ul>

### Assessment Strategies

The learner:

- draws the workshop layout.
- draws production line layout and arranges material access roads.
- uses factory protection and security systems.
- describes the temporary services: water, gas, electricity, telephone, generators, toilets, drainage, kitchen and dining.

### Resources

- Relevant textbooks
- Documentaries
- Computer and projector
- Flip chart



## Sub-module 3: Safety, Health and Welfare

Duration: 6 Hours

Competence(s)	Content	Teaching Strategy
<p>The learner:</p> <ul style="list-style-type: none"> <li>observes safety regulations and safe working conditions in industry and on fabrication sites and prevents accidents.</li> <li>discusses the safe working conditions, maintenance and inspection of mechanical plant.</li> <li>discusses the importance of the provision of food and drinks, washing and toilet facilities and nurse and first aid.</li> <li>observes safety and prevents accidents and uses safety wear.</li> <li>analyses the importance of transport and temporary housing for labour.</li> <li>carries out health and</li> </ul>	<ul style="list-style-type: none"> <li>Regulations and safe working conditions in industry and on fabrication sites concerning access and scaffolding</li> <li>Safe working conditions, maintenance and inspection of mechanical plant, hoists, cranes, portable tools and electrical equipment</li> <li>Provision of food and drinks, washing and toilet facilities</li> <li>Provision of a nurse and first aid</li> <li>Safety and prevention of accidents</li> <li>Safety wear</li> <li>Transport and temporary housing for labour. For example, storage, changing / dressing rooms</li> <li>Health and safety education, notices and warning signage</li> <li>Responsibility to</li> </ul>	<ul style="list-style-type: none"> <li>Demonstrate how to apply regulations and safe working conditions in industry and on fabrication sites concerning access and scaffolding.</li> <li>Lead a guided discussion on description of safe working conditions, maintenance and inspection of mechanical plant, hoists, cranes, portable tools and electrical equipment.</li> <li>Lead a guided discussion on the importance of the provision of food and drinks, washing and toilet facilities.</li> <li>Lead a guided discussion on use of the provision of a nurse and first aid.</li> <li>Illustrate how to observe safety and prevent accidents.</li> <li>Illustrate how to use safety wear.</li> <li>Lead a guided discussion on description of the importance of transport and temporary housing for</li> </ul>

Competence(s)	Content	Teaching Strategy
<p>safety education and posters and warning signage.</p> <ul style="list-style-type: none"> <li>discusses the responsibility of third party and insurance.</li> <li>analyses the application of production regulations, statutory requirements and fees.</li> <li>analyses and observes the employment regulations and legislations.</li> </ul>	<p>third party and insurance</p> <ul style="list-style-type: none"> <li>Production regulations, statutory requirements and fees</li> <li>Employment legislation and manufacturing regulations, incentive schemes and their operation in the manufacturing industry</li> </ul>	<p>labour. For example, storage, changing / dressing rooms.</p> <ul style="list-style-type: none"> <li>Illustrate how to carry out health and safety education and posters and warning signage.</li> <li>Lead a guided discussion on responsibility of third party and insurance.</li> <li>Demonstrate the application of production regulations, statutory requirements and fees.</li> <li>Illustrate how to observe employment regulations and legislations.</li> </ul>

### Assessment Strategies

The learner:

- applies regulations and safe working conditions in industry and on fabrication sites concerning access and scaffolding.
- describes safe working conditions, maintenance and inspection of mechanical plant, hoists, cranes, portable tools and electrical equipment.
- observes safety and prevents accidents.
- describes the importance of transport and temporary housing for labour, for example, storage, changing / dressing rooms.
- carries out health and safety education and posters, and warning signage.
- outlines responsibility of third party and insurance.
- applies the production regulations, statutory requirements and fees.
- observes employment regulations and legislations.

## Resources

- Relevant textbooks
- Documentaries
- Computer and projector
- Flip chart

## Sub-module 4: Important Factory Documents

Duration: 3 Hours

Competence(s)	Content	Teaching Strategy
The learner: <ul style="list-style-type: none"> <li>• writes factory reports to head office.</li> <li>• prepares, maintains and uses different factory documents such as: instructions book, day-works records, progress reports, departure time books and wage sheets, materials log.</li> </ul>	<ul style="list-style-type: none"> <li>• Reports to head office</li> <li>• Instructions book</li> <li>• Day-works</li> <li>• Variations</li> <li>• Progress reports</li> <li>• Reporting and departure time books and wage sheets</li> <li>• Materials log</li> <li>• Notifications to and factory inspection by authorities</li> <li>• Accidents and sickness report / records book</li> <li>• Weather report book</li> </ul>	<ul style="list-style-type: none"> <li>• Illustrate how to write factory reports to head office.</li> <li>• Lead a guided discussion on how to prepare and keep instructions book.</li> <li>• Lead a guided discussion on how to Keep day-works records.</li> <li>• Demonstrate how to determine the variations.</li> <li>• Illustrate the preparation and keeping of progress reports.</li> <li>• Illustrate how to prepare and keep reporting and departure time books and wage sheets.</li> <li>• Lead a guided discussion on use of materials log.</li> <li>• Illustrate the use of notifications to and factory inspection records by authorities.</li> <li>• Lead a guided discussion on how to prepare and keep Accidents and sickness report / records book.</li> <li>• Lead a guided discussion on how to prepare and keep weather report book.</li> </ul>

## Assessment Strategies

The learner:

- writes factory reports to head office.
- prepares and keeps instructions book.
- keeps day-works records.
- determines the variations.
- prepares and keeps progress reports.
- prepares and keeps reporting and departure time books and wage sheets.

### Resources

- Relevant textbooks
- Documentaries
- Computer and projector
- Flip chart

## Sub-module 5: Management of Materials

Duration: 3 Hours

Competence(s)	Content	Teaching Strategy
The learner: <ul style="list-style-type: none"> <li>• describes scaffolding, types and erection consideration of distribution and hoisting materials.</li> <li>• prepares schedules for resource allocation and forecasts materials requirements.</li> <li>• practises on processing, ordering, checking, storage, protection, transport,</li> </ul>	<ul style="list-style-type: none"> <li>• Scaffolding, types and erection consideration of distribution and hoisting materials</li> <li>• Preparation of schedules, forecasting material requirements</li> <li>• Processing, ordering, checking, storage, protection, transport, loading and handling of materials</li> <li>• Stock taking of materials</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on description of scaffolding, types and erection consideration of distribution and hoisting materials.</li> <li>• Demonstrate how to prepare schedules for resource allocation and forecasts material requirements.</li> <li>• Illustrate how to carry out stock taking and handling of materials.</li> <li>• Guide learners to practice on processing, ordering, checking, storage, protection, transport, loading and handling.</li> <li>• Guide the learner to</li> </ul>

Competence(s)	Content	Teaching Strategy
loading and handling of materials. <ul style="list-style-type: none"> <li>carries out stock taking.</li> </ul>		practice stock taking of materials.

### Assessment Strategies

The learner:

- does exercise to describe occurrences of: occupational health, occupational safety.
- prepares schedules for resource allocation and forecasts material requirements.
- does exercise in which he/she carries out stocktaking and handling of materials.

### Resources

- Relevant textbooks
- Documentaries
- Computer and projector
- Flip chart

## Sub-module 6: Manufacturing Plant and Equipment

Duration: 2 Hours

Competence(s)	Content	Teaching Strategy
<b>The learner:</b> <ul style="list-style-type: none"> <li>• identifies the various types of manufacturing plants.</li> <li>• demonstrates how to organise, control and maintain manufacturing plants.</li> <li>• illustrate the maintenance of manufacturing plants.</li> </ul>	<ul style="list-style-type: none"> <li>• Types of manufacturing plants</li> <li>• Organisation and control of manufacturing plants</li> <li>• Maintenance of manufacturing plants</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on identification of the various types of manufacturing Plants.</li> <li>• Lead a guided discussion on how to organise and control manufacturing plants</li> <li>• Illustrates how to maintain manufacturing plants.</li> </ul>

**Assessment Strategy**

The learner describes how to identify the various types of manufacturing plants, their organisation, control and maintenance.

**Resources**

- Relevant textbooks
- Documentaries
- Computer and projector
- Flip chart

**Sub-module 7: Labour Management**

Duration: 2 Hours

Competence(s)	Content	Teaching Strategy
<p>The learner:</p> <ul style="list-style-type: none"> <li>• illustrates the assessment and forecasting of labour requirements.</li> <li>• describes availability of labour and requirements.</li> <li>• demonstrates the application of the incentives; financial and non-financial.</li> <li>• illustrates how to measure and record labour in relation to work output.</li> </ul>	<ul style="list-style-type: none"> <li>• Assessing and forecasting labour requirements</li> <li>• Availability of labour and requirements</li> <li>• Incentives: financial and non-financial</li> <li>• Measuring and recording labour in relation to work output</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on assessment and forecasting labour requirements.</li> <li>• Lead a guided discussion on description of availability of labour and requirements.</li> <li>• Lead a guided discussion on application of the incentives : financial and non-financial.</li> <li>• Demonstrate how to measure and record labour in relation to work output.</li> </ul>

## Assessment Strategies

The learner:

- assesses and forecasts labour requirements.
- describe availability of labour and requirements.
- measures and records labour in relation to work output.

## Resources

- Relevant textbooks
- Documentaries
- Computer and projector
- Flip chart

## Sub-module 8: Workshop Control

Duration: 3 Hours

Competence(s)	Content	Teaching Strategy
The learner: <ul style="list-style-type: none"> <li>• prepares forecasting, overall programme and short-term programme</li> <li>• discusses crash programme in terms of objective, use and effect</li> <li>• maintains project progress records and feedback</li> <li>• uses project software to track progress of the project</li> </ul>	<ul style="list-style-type: none"> <li>• Forecasting, overall programme and short-term programme</li> <li>• Crash programme: objective, use and effect</li> <li>• Progress records and feedback of information</li> <li>• Software               <ul style="list-style-type: none"> <li>- microsoft project</li> <li>- planning and project management software</li> <li>- spread sheets</li> <li>- microsoft access</li> <li>- job master</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Guide the learner on preparation of forecasting, overall programme and short term programme</li> <li>• Guide the learner to discuss crash programme in terms of objective, use and effect</li> <li>• Lead a guided discussion on keeping of progress records and feedback of information</li> <li>• Demonstrate the use of project Software:               <ul style="list-style-type: none"> <li>- microsoft project</li> <li>- planning and project management software</li> <li>- spread sheets</li> <li>- microsoft access</li> <li>- job master</li> </ul> </li> </ul>

**Assessment Strategies**

The learner:

- describes occurrences of: occupational health, occupational safety.
- describes occupational hazards, occupational accidents, occupational diseases.
- demonstrates Keeping Progress records and feedback of information.
- applies software on project.

**Resources**

- Relevant textbooks
- Documentaries
- Computer and projector
- Flip chart

**Sub-module 9: Safety and Security in Industries**

Duration: 3 Hours

Competence(s)	Content	Teaching Strategy
<p>The learner:</p> <ul style="list-style-type: none"> <li>• uses safety wear in during operations.</li> <li>• observes, controls and promotes industrial safety and security regulations.</li> <li>• illustrates the control noise and pollution.</li> </ul>	<ul style="list-style-type: none"> <li>• Safety wear</li> <li>• Safety of the public, hoarding, traffic control and guarding</li> <li>• Safety from plants and machinery</li> <li>• Safety education and posters and warning signage</li> <li>• Noise and pollution control</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on the use of safety wear in industries during operations.</li> <li>• Illustrate the description of the safety of the public, hoarding, traffic control and guarding.</li> <li>• Lead a guided discussion on how to carry out safety education and posters and warning signage.</li> <li>• Lead a guided discussion on how to control noise and pollution.</li> </ul>



## Assessment Strategies

The learner:

- writes down safety gears used in industries during operations.
- describes the safety of the public, hoarding, traffic control and guarding.
- carries out safety education and posters and warning signage.
- demonstrates how to Control noise and pollution.

## Resources

- Relevant textbooks
- Documentaries
- Computer and projector
- Flip chart

## Sub-module 10: Welfare in Industries

Duration: 1 Hour

Competence(s)	Content	Teaching Strategy
<p><b>The learner:</b></p> <ul style="list-style-type: none"> <li>• describes the importance of timely payments and the benefits of insurance schemes in industries.</li> <li>• describes the necessity for equitable treatment in the industries.</li> <li>• demonstrates application of industrial welfare schemes, labour laws and relations.</li> </ul>	<ul style="list-style-type: none"> <li>• Timely payments</li> <li>• Insurance schemes</li> <li>• Equitable treatment</li> <li>• Labour laws and relations</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on description of the importance of timely payments.</li> <li>• Lead a guided discussion on description of the benefits of insurance schemes in the industries.</li> <li>• Lead a guided discussion on the description of the necessity for equitable treatment in the industries.</li> <li>• Demonstrate how to apply labour laws and relations at work.</li> </ul>

**Assessment Strategies**

The learner:

- describes the importance of timely payments.
- illustrates benefits of insurance schemes in the industries.
- demonstrates how to apply labour laws and relations at work.

**Resources**

- Relevant textbook
- Documentaries
- Computer and projector
- Flip chart

## Sub-module 11: Environmental Consideration in Industries

Duration: 1 Hour

Competence(s)	Content	Teaching Strategy
<p>The learner:</p> <ul style="list-style-type: none"> <li>• identifies wastes and describes their disposal.</li> <li>• illustrates the application of wetland preservation, protection measures.</li> <li>• demonstrates the methods of controlling noise and dust pollution and diversions.</li> <li>• abides by environmental preservation and protection measures and applies environmental legislation.</li> </ul>	<ul style="list-style-type: none"> <li>• Industrial wastes and their disposal (e.g. re-use re-cycling, land filling treatment)</li> <li>• Wetland preservation, protection</li> <li>• Noise and dust pollution and diversions</li> <li>• Environmental legislation</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on description of wastes and their disposal (e.g. re-use re-cycling, land filling treatment).</li> <li>• Lead a guided discussion on application of wetland preservation, protection measures.</li> <li>• Demonstrate how to control noise and dust pollution and diversions.</li> <li>• Demonstrate how to apply environmental legislation.</li> </ul>

### Assessment Strategies

The learner:

- describes wastes and their disposals (e.g. re-use re-cycling, land filling treatment).
- applies wetland preservation, protection measures.
- does exercise on how to control noise and dust pollution and diversions.
- demonstrates application of environmental legislation.

### Resources

- Relevant textbooks
- Documentaries
- Computer and projector
- Flip chart

## Sub-module 12: Construction and Related Laws

Duration: 2 Hours

Competence(s)	Content	Teaching Strategy
The learner describes and observes production, condominium, labour and other tenacity laws and regulations.	<ul style="list-style-type: none"> <li>• Production laws and regulations</li> <li>• Labour laws</li> <li>• Condominium law and other tenacity laws</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on application of production laws and regulations.</li> <li>• Lead a guided discussion on application of labour laws.</li> <li>• Lead a guided discussion on how to comply with condominium law and other tenacity laws.</li> </ul>

### Assessment Strategies

The learner:

- demonstrates application of production laws and regulations.
- illustrates the use of condominium law and other tenacity laws.

### Resources

- Relevant textbooks
- Documentaries
- Computer and projector
- Flip chart

## TDCR 224: Foundry (Casting)

### Year 1 Term 2

Duration: 30 Hours

#### Module Overview

This module introduces the learner to casting of products like decorative designs, ladles, faring pans, pipe bending dies.

#### Learning Outcome

By the end of this module, the learner should be able to carry out castings and make designed products.

#### Preparatory Assignment

The learner is given a task to identify forged tools from the tool store.

#### Result

The learner writes a report and submits to the teacher for analysis.

### Sub-module 1: Introduction to Foundry Work

Duration: 8 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"> <li>observes safety precautions.</li> <li>describes types of foundry work.</li> <li>selects tools and equipment appropriately.</li> </ul>	<ul style="list-style-type: none"> <li>Safety precaution</li> <li>Definitions of foundry terms</li> <li>Types of foundry work</li> <li>Tools and equipment</li> </ul>	<ul style="list-style-type: none"> <li>Lead a guided discussion on the origin and applications of forging, description of the items applied in foundry.</li> <li>Lead a guided discussion on the types of foundry work.</li> <li>Display tools and equipment for the learner to select.</li> </ul>

### Assessment Strategies

The learner:

- does assignment on identification of the tools and equipment used in foundry.
- does classwork on safety precaution and types of foundry work.

### Resources

- Charts
- Forging tools

## Sub-module 2: Sand Casting

Duration: 26 Hours

Competences	Content	Teaching Strategies
<p><b>The learner:</b></p> <ul style="list-style-type: none"> <li>• discusses advantages and disadvantages of casting.</li> <li>• makes shell moulds.</li> <li>• makes patterns and prepares moulds.</li> <li>• cures moulds.</li> <li>• carries out the hardening, and normalising of product.</li> <li>• safely removes and finishes castings.</li> </ul>	<ul style="list-style-type: none"> <li>• Advantages and disadvantages of casting</li> <li>• Making the shell mould</li> <li>• Types of patterns</li> <li>• Pattern making</li> <li>• Sand preparation</li> <li>• Moulding and core making</li> <li>• Curing of moulds</li> <li>• Gating and risering of castings</li> <li>• Melting and pouring of molten metal</li> <li>• Removal and finishing of castings</li> </ul>	<ul style="list-style-type: none"> <li>• Lead a guided discussion on advantages and disadvantages of casting.</li> <li>• Illustrate and demonstrate the procedures of making patterns, shell moulding and treatment of the products.</li> <li>• Demonstrate the process of melting and casting the molten metal or plastic and the techniques applied to remove the casted product.</li> </ul>

### Assessment Strategies

The learner:

- melts and casts the molten metal or plastic to form an article.
- does homework on advantages and disadvantages of casting.

**Sub-module 3: Defects in Sand Casting**

Duration: 16 Hours

Competences	Content	Teaching Strategies
The learner: <ul style="list-style-type: none"><li>describes defects in sand casting.</li><li>minimises/controls defects in sand casting.</li><li>operates and maintains furnaces.</li></ul>	<ul style="list-style-type: none"><li>Tears and cracks</li><li>Shrinkage</li><li>Porosity</li><li>Dimensional defects</li></ul>	<ul style="list-style-type: none"><li>Lead a guided discussion on the causes of tears and cracks on casted products and preventive measures to be taken care of.</li><li>Lead a guided discussion on the causes of shrinkage and porosity on casted products and suggest methods of limiting their effect.</li></ul>

**Assessment Strategies**

The learner does assignment on shrinkage and porosity on casted products.

## NDCME 231: Industrial Training 11

### Module Overview

This module introduces the learner to the industry where skills are required.

### Learning Outcome

The learner acquires practical skills.

Competences	Content	Teaching strategies
The learner: <ul style="list-style-type: none"> <li>• designs new models.</li> <li>• draws articles to scale.</li> <li>• carries out biscuit and glost firing.</li> <li>• calculates glazes.</li> <li>• calculates and applies them in batching .</li> <li>• produces glazes.</li> <li>• sieves clay.</li> <li>• puts the slip in moulds.</li> <li>• removes clay from the moulds.</li> <li>• wedges clay.</li> <li>• stores clay.</li> <li>• blunges clay.</li> <li>• prepares clay balls.</li> <li>• centres clay balls.</li> <li>• pulls the centred clay.</li> <li>• makes cylinders.</li> <li>• shapes in any desired shapes.</li> <li>• puts in damp room.</li> <li>• dries the articles.</li> <li>• fires the articles.</li> <li>• sorts the articles and grades them for sale.</li> <li>• observes health, safety and welfare.</li> <li>• acquaints with the industry.</li> </ul>	<ul style="list-style-type: none"> <li>• Designing and drawing to scale</li> <li>• A tea set</li> <li>• Producing the set of table ware</li> <li>• Firing to biscuit</li> <li>• Glaze and glost fire the articles</li> <li>• Glaze calculations</li> <li>• Produce glazes</li> <li>• Kiln firing</li> </ul>	<ul style="list-style-type: none"> <li>• Illustrate and demonstrate how to design new models</li> <li>• Illustrate the skills applied in drawing to scale</li> <li>• Illustrate the methods of biscuit firing</li> <li>• Demonstrate glost firing</li> <li>• Place the learner for industrial training</li> <li>• Supervise the learner on industrial training</li> <li>• Lead a guided discussion on health, safety and welfare, relating with workers, site organization and material management</li> <li>• Illustrate report writing</li> </ul>

Competences	Content	Teaching strategies
<ul style="list-style-type: none"> <li>relates with workers.</li> <li>organises, administers and manages materials.</li> <li>writes reports.</li> </ul>		

### Assessment Strategies

The learner:

- designs and draws objects to scale.
- practises making items and expedite ones creativity.
- looks for places for industrial training.
- prepares the material for supervision.
- observes the health, safety and welfare, relating with workers, site organisation and material management.
- applies health, safety and welfare.
- relates with workers at industry.
- writes industrial training report and submits to the teacher.

### Resources

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>Log books</li> <li>Training manual</li> <li>Clay</li> <li>Sieves</li> <li>Moulds</li> <li>Levelled surface</li> <li>Damp room</li> <li>Storage bins</li> <li>Potter's wheel</li> <li>Sponge</li> <li>Cutting wire</li> </ul> | <ul style="list-style-type: none"> <li>wire</li> <li>Gum boots</li> <li>Knives</li> <li><i>Ceramics</i> by singer</li> <li>Drying shades</li> <li>Kiln</li> <li>Buckets</li> <li>Gloves</li> <li>Overalls</li> <li>Helmets</li> <li>Trucks</li> </ul> |
|---|---|



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## **Appendix 2: Software**

- ArchCAD
- AutoCAD
- Adobe Illustrator
- Microsoft Access
- Ms Word
- Power Point
- Spread Sheets
- Planning and Project Management Software

## Appendix 3: Tools and Equipment

- Electric kiln
- Digital program controller
- Electric test kiln
- Jigger machine
- Original mould jiggering machine
- Vacuum stirring machine for plaster Paris
- Silicon slabs 320 x 320x 10mm
- L- Type support 160mm
- L-Type support 60mm
- Cube support 30 x 40 x 55mm
- Cube support 20 x 30 x 40mm
- Electric potters' wheels
- Portable kick wheels
- Fixed vertical electric pug mill
- Portable table pug mill
- Ball mills of 1 litre, 2 litres, 4 litres and 5 litres capacity
- Callipers
- Stanley knives
- Vacuum spray
- Vacuum spray pump
- Desecrator
- Table with rotating head
- Electric bungler - 20 litres
- Laboratory (stirrer/blunger)
- Work bench
- Hoes
- Spades
- Wheelbarrows
- Filter press
- Nasal masks
- Spanners
- Screwdrivers
- Sieves- 80 "mesh to 320" mesh
- Autoclave
- Oven fitted with thermometer - 300°C
- Tongs
- Stop watches
- Analytical balances
- Weighing scales - 5 kilos
- Moisture tester
- Pick and axe
- Drawing boards (30)
- Drawing instruments
- T-squares
- Set squares
- Protractors
- Compact disks
- Computers (30)
- Computer tables and chairs (30)
- LaserJet printers
- Lathe machine





National Curriculum Development Centre  
Ministry of Education and Sports  
P.O. Box 7002, Kampala  
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