Republic of Rwanda
Ministry of Education

RTB | RWANDA TVET BOARD

BASIC TECHNICAL DRAWING AND AUTOCAD

PLTTD401

Apply basic technical drawing and AutoCAD

Competence

RQF Level: 4

Learning Hours



110

Credits: 11

Sector: **Construction and Building Services**

Trade: **Plumbing Technology**

Module Type: General

Curriculum: BDPLT4001- TVET Certificate 4 in Construction and building services

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<table>
<tr><td>Purpose statement</td><td colspan="6">This module describes the knowledge, skills, and attitudes to be acquired by the leaner so that he/she can apply technical drawing fundamentals, to produce plumbing drawing, describe AutoCAD software and create plumbing drawings. At the end of the module, leaner will be able to interpret construction drawing, produce plumbing system drawing and to draw plumbing system layout using AutoCAD software.</td></tr>
<tr><td>Learning assumed to be in place</td><td colspan="6">No applicable</td></tr>
<tr><td rowspan="6">Delivery modality</td><td colspan="2">Training delivery</td><td>100%</td><td colspan="2">Assessment</td><td>Total 100%</td></tr>
<tr><td colspan="2">Theoretical content</td><td>30%</td><td rowspan="4">Formative assessment</td><td>30%</td><td rowspan="4">50%</td></tr>
<tr><td colspan="2">Practical work:</td><td rowspan="3">70%</td><td rowspan="3">70%</td></tr>
<tr><td>• Group work and presentation</td><td>30%</td></tr>
<tr><td>• Individual work</td><td>40%</td></tr>
<tr><td colspan="3"></td><td colspan="2">Summative Assessment</td><td>50%</td></tr>
</table>

Elements of Competency and Performance Criteria

Elements of competency	Performance criteria
1. Apply technical drawing fundamentals	1.1. Drawing instruments and materials are properly identified based on specification
	1.2 Types of lines and scale are interpreted properly according to the type of drawing
	1.3 Drawing symbols used in construction drawing are accurately interpreted with respect to their use
	1.4 Dimension is systematically applied according to the type of drawing
	1.5 Drawing projection is properly applied referring to needed details

	1.6 Construction drawing are correctly interpreted according to required information
2. Produce Plumbing drawing	2.1 Plumbing design information is properly identified according to project details
	2.2 Drawing symbols used in Plumbing drawing are accurately interpreted with respect to standards
	2.3 Plumbing system is drawn according to the construction Drawing
3. Describe AutoCAD software	3.1 AutoCAD software is adequately described as per developer
	3.2 AutoCAD software is properly installed as per installation user guide
	3.3 AutoCAD user interface is appropriately Explored according to chosen workspace
	3.4 Basic operations are perfectly applied in AutoCAD
4. Create Drawings	4.1 AutoCAD workspace is correctly customized / Created according to the given work
	4.2 Layers are properly created and named as per types of drawings
	4.3 Plumbing drawings are perfectly created using coordinates
	4.4 Plumbing drawings are perfectly created using AutoCAD Drawing tools/Commands
	4.5 Hatches and fills are correctly applied as per drawings requirements
	4.6 Blocks are correctly Annotated and used/inserted as per drawings or object types
	4.7 Annotation tools are correctly used according to the types of notes and dimensions to be added
	4.8 Title block is appropriately created according to the use of the drawings

Intended Knowledge, Skills, and Attitude

Knowledge	Skills	Attitude
✓ Identify annotations and labelling ✓ Identify types of lines	✓ Interpret plumbing drawings ✓ Perform CAD basic settings ✓ Create geometrical shapes	✓ Use creativity and innovation throughout the design works

✓ Describe the geometrical shapes ✓ Identify CAD installation requirements ✓ Identify CAD tools ✓ Identify layout ✓ Identify plumbing symbols	✓ Apply dimensions ✓ Perform Printing ✓ Create design layout ✓ Prepare design project presentation	✓ Pay attention to design projects details ✓ Demonstrate punctuality during the implementation of design project ✓ Demonstrate resourcefulness in the new design trends

Course content

Learning outcomes	**At the end of the module the learner will be able to:** 1. Apply technical drawing fundamental 2. Produce Plumbing drawing 3. Describe AutoCAD software 4. Create Drawings

Learning outcome 1: Apply technical drawing fundamental	**Learning hours: 10 Hours**
Indicative content	

- **Drawing instruments and materials identification**
  - ✓ **Types of drawing instruments**
    - Writing instruments
    - Tracing instruments
    - Accessory instruments
  - ✓ **Drawing materials**
    - Types of drawing papers
    - Drawing papers format and sizes
    - Layout of drawing sheet (borderlines, title block)

- **Description of drawing lines and scales**
  - ✓ Types of lines used in drawing
  - ✓ Use of drawing lines types
  - ✓ Types of scale
  - ✓ Use of scale
- **Interpretation of symbols used in construction drawing**
  - ✓ Types of symbols
  - ✓ Use of symbols
- **Drawing dimension**
  - ✓ Types of dimensions
  - ✓ Method of dimensioning
  - ✓ Elements of dimensioning
- **Drawing projection**
  - ✓ Orthographic projection (views)
  - ✓ Isometric projection
  - ✓ Sections
- **Construction drawing interpretation**
  - ✓ Plans (floor plan, site plan, location plan)
  - ✓ Views
  - ✓ Sections

Resources required for the learning outcome	
Equipment	Drawing pins and clips, Compass, drawing pencil, drawing board, Drawing tables
Materials	Construction drawing handout, A3 Papers, A2 Papers, A1 Papers, A0 Papers, Inks, Eraser, Pencil lead, Lead
Tools	Books, Internet, Handouts, Ink-pen, Pencils, set squares, Protractor, Compass, French curves, Template, Pantograph, Proportion divider, Scale rule, Pencil, sharpener, making tape, Drawing board, Knife, Scissors
Facilitation techniques	Group discussion, Trainer guided, Matching questions, Multiple choice, Sentence completion, Short questions, Essay, Open ended questions
Formative assessment methods /(CAT)	Written assessment, Performance assessment, Product based assessment

Learning outcome 2: Produce Plumbing drawing	Learning hours: 40 Hours

Indicative content

- **Plumbing design information identification**
  - ✓ Design code and specifications
  - ✓ System components
  - ✓ Design documents
- **Sketch of Plumbing symbols**
  - ✓ Types of plumbing drawing (single line drawing, double line)
  - ✓ Piping symbols
  - ✓ Fixtures and appliances
- **Drawing of Plumbing system**
  - ✓ System layout drawing
    - Water distribution pipe
    - Firefighting system
    - Drainage system
    - Gas supply system
  - ✓ Detailed drawing
    - Water tank connection
    - Pump connection
    - Septic tank
    - Soak pits

Resources required for the learning outcome

Equipment	Drawing pins and clips, Compass, drawing pencil, drawing board, Drawing tables
Materials	Construction drawing handout, A3 Papers, A2 Papers, A1 Papers, A0 Papers, Inks, Eraser, Pencil lead, Lead
Tools	Books, Internet, Handouts, Ink-pen, Pencils, set squares, Protractor,

	Compass, French curves, Template, Pantograph, Proportion divider, Scale rule, Pencil, sharpener, making tape, Drawing board, Knife, Scissors
Facilitation techniques	Group discussion, Trainer guided, Matching questions, Multiple choice, Sentence completion, Short questions
Formative assessment methods /(CAT)	Written assessment, Performance assessment, Product based assessment

Learning outcome 3 : Describe AutoCAD software	**Learning hours:25 Hours**
Indicative content	

- **Description of AutoCAD software**
  - ✓ CAD and History of CAD
  - ✓ AutoCAD and History AutoCAD
  - ✓ AutoCAD uses and users
  - ✓ Benefits of using AutoCAD software
- **AutoCAD software Installation**
  - ✓ AutoCAD installation requirements
  - ✓ AutoCAD Licensing
  - ✓ AutoCAD Installation process
- **Exploring AutoCAD user interface**
  - ✓ Starting AutoCAD
  - ✓ AutoCAD default Workspaces
  - ✓ Keyboard and Mouse Functions
  - ✓ Opening or accessing an existing Drawings
  - ✓ Application Menu
  - ✓ Elements of the menu bar
  - ✓ Elementsof quick Access Toolbar
  - ✓ Ribbon
  - ✓ Elements of the Status Bar
  - ✓ File Tabs

- ✓ Layout Tabs
- ✓ Toolbars
- ✓ Command Line

- **Apply Basic operations in AutoCAD**
  - ✓ Create New drawing
  - ✓ Open an Existing drawing
  - ✓ Save/Save as
  - ✓ Undo/Redo
  - ✓ Pan
  - ✓ Zoom
  - ✓ AutoCAD file formats

Resources required for the learning outcome	
Equipment	Computer laboratory, projector, flip chart, mark pens, Board, Electricity, Electrical cables
Materials	Eraser, drawing papers
Instrument	Ruler, ink pen, pencils, pencils sharpener
Facilitation techniques	Group discussion, Trainer guided
Formative assessment methods /(CAT)	Written assessment, Oral assessment, Practical assessment, Matching questions, Multiple choice, short questions

Learning outcome4: Create Drawings	**Learning hours: 35 Hours**

Indicative content

- **Workspace Customization / creation**
  - ✓ 2D Drafting and Annotation Workspace customization
  - ✓ Display specific menus;
  - ✓ Display specific toolbars;
  - ✓ Display specific palettes;
  - ✓ Display specific ribbon panels.

- ✓ New Workspace creation
- ✓ Display specific menus, toolbars, palettes, and panels

- **Working with layers**
  - ✓ Creation of layers
  - ✓ Naming/renaming layers
  - ✓ Modification of layer properties
  - ✓ Freezing/ thawing layers
  - ✓ Changing layer colours
  - ✓ Working with a specific layer
- **Create drawings with coordinates**
  - ✓ Drawing with absolute Coordinates
  - ✓ Drawing with relative Coordinates
- **Create Plumbing Drawings are perfectly created using AutoCAD Drawing tools/Commands**
  - ✓ Line, Polyline, Erase, Rectangle, Circle, Arc, Polygon, Spline, Table
  - ✓ Drawing limits
  - ✓ Apply AutoCAD Status Bar toggles (Dynamic Input, Polar Tracking)
  - ✓ Apply Editing/modifying commands
  - ✓ Offset, Trim, Extend, Stretch, Fillet, Rotate, Mirror, Move, Copy, Array, Scale, Explode, Break
- **Apply Hatches and Fills**
  - ✓ The hatch Command
  - ✓ Solid Hatches
  - ✓ Editing properties of hatches
  - ✓ The sketch Command
  - ✓ Gradients
- **Work with Blocks**
  - ✓ Insert a Bloc
  - ✓ Create Blocks within a Drawing
  - ✓ Modify a block
  - ✓ Group objects
  - ✓ Create Block Libraries
- **Annotation**
  - ✓ Changing annotative settings
  - ✓ Work with annotative Object Scale dialog

- ✓ Set annotation scale
- ✓ Add dimensions with Dimensions pallet tools
- ✓ Add dimensions with text pallet tools
- ✓ Add dimensions and text using command / Command line

- **Create title block**
  - ✓ Identification of elements of the title bloc
  - ✓ Title block templates
  - ✓ Title block creation

Resources required for the indicative content	
Equipment	Computer laboratory, projector, Flip chart, Mark pens, Board, Electricity, Electrical cables
Materials	Eraser, drawing papers
Instrument	Ruler, ink-pen, pencils, pencil sharpener
Facilitation techniques	Group discussion, Trainer guided, Matching questions, Multiple choice Short questions
Formative assessment methods	Written assessment, Oral assessment, Practical assessment

References:

1. Alva Mitchel, etal. (2017). Technical Drawing, International Kinder white

2. Colin Simon Et Al. Manual of Engineering Drawing, 4th Edition Elsevier

3. Frederick E. Giesecke (2016). Technical Drawing Eighth Edition, Odd Mix BOOKS

4. AutoCAD basics. (2020). In *Construction Detailing for Interior Design*. https://doi.org/10.5040/9781501326431.ch-003

5. Butorina, I. V., & Vasilieva, N. (2018). Parametric modeling in architectural and construction design in AutoCAD. *IOP Conference Series: Materials Science and Engineering*. https://doi.org/10.1088/1757-899X/451/1/012121

6. Gindis, E. J., & Kaebisch, R. C. (2022). AutoCAD fundamentals—Part II. In *Up and Running with AutoCAD® 2022*. https://doi.org/10.1016/b978-0-323-89923-9.00002-0

7. Irawan M. R, I., & H.M, A. (2017). *A CASE STUDY OF AUTOCAD 2D ENGINEERING DRAWING PERFORMANCE AMONG FURNITURE AND PRODUCT DESIGN (BFPD) STUDENTS*. https://doi.org/10.17501/icedu.2017.3106

8. Onstott, S. (2017). AutoCAD® and AutoCAD LT® Essentials. In *AutoCAD® and AutoCAD LT® Essentials*. https://doi.org/10.1002/9781119414124

9. Sadeghpour, F., Moselhi, O., & Alkass, S. T. (2006). Computer-Aided Site Layout Planning. *Journal of Construction Engineering and Management*. https://doi.org/10.1061/(asce)0733-9364(2006)132:2(143)

10. Saputro, B. E., & Supratno, S. (2020). Implementation of the use of AutoCAD applications in increasing basic competence in describing techniques in vocational education. *IOP Conference Series: Materials Science and Engineering*. https://doi.org/10.1088/1757-899X/830/4/042022

11. Up and Running with AutoCAD® 2022. (2022). In *Up and Running with AutoCAD® 2022*. https://doi.org/10.1016/c2020-0-03148-8

12. Zhao, Z., & Zhu, X. (2019). Automatic drawing technique for horizontal projection diagrams of exploration borehole deviations. *Multimedia Tools and Applications*. https://doi.org/10.1007/s11042-018-6659-0

13. Ziden, A. A., Zakaria, F., & Othman, A. N. (2012). Effectiveness of AutoCAD 3D Software as a

learning support tool. *International Journal of Emerging Technologies in Learning*. https://doi.org/10.3991/ijet.v7i2.1906