Republic of Rwanda
Ministry of Education

RTB | RWANDA TVET BOARD

COMPUTER AIDED DESIGN

GENCAD401

Apply Computer Aided Design

Competence

RQF Level: 4

Learning Hours 60

Credits: 6

Sector: Energy

Trade: Renewable Energy

Module Type: GENERAL

Curriculum: ENGREN4001-TVET Level IV in Renewable Energy

Issue Date: August 2023

<table>
<tr><td>Purpose statement</td><td colspan="5">This module describes the skills, knowledge and attitude required to apply CAD Software especially AutoCAD, Solid works and MULTISIM. At the end of this module, learners will be able to create 2D and 3D drawings, models and designs. He/she will be able to draw mechanical designs, assemblies, simulations, and analyse electronic circuits.

Qualified learners deemed competent to this competency may work alone or with others on routine tasks in engineering design.</td></tr>
<tr><td>Learning assumed to be in place</td><td colspan="5">N/A</td></tr>
<tr><td rowspan="6">Delivery modality</td><td>Training delivery</td><td colspan="2">100%</td><td colspan="2">Assessment</td><td>Total 100%</td></tr>
<tr><td>Theoretical content</td><td colspan="2">30%</td><td rowspan="4">Formative assessment</td><td>30%</td><td rowspan="4">50%</td></tr>
<tr><td>Practical work:</td><td colspan="2">70%</td><td rowspan="3">70%</td></tr>
<tr><td>Group project and presentation</td><td>20%</td><td rowspan="2">70%</td></tr>
<tr><td>Individual project /Work</td><td>50%</td></tr>
<tr><td></td><td colspan="3">Summative Assessment</td><td>50%</td></tr>
</table>

Elements of Competency and Performance Criteria

Elements of competency	Performance criteria
1. UseAutoCAD Software	1.1. AutoCAD is properly installed based on software's minimum system requirements and installation wizard
	1.2. Working space is properly customized based on chosen AutoCAD Workspace
	1.3. Layers are properly created using layer panel based on the project.
	1.4. Geometric Objects are appropriately drawn using draw panel, toolbar or tool palettes or command bar
	1.5. Existing Objects are appropriate modified using modify commands
	1.6. Annotations (dimensions, leaders and texts) are properly applied to the drawing using annotation panel
	1.7. Drawing is properly plotted based on layout, scale and paper size.
2. Use SolidWorks Software	2.1. SolidWorks is properly installed based on software's minimum system requirements and installation wizard/process
	2.2. Workspace is properly customized based on chosen template and work to be done
	2.3. Part Object are properly drawn using Create parts template tools (selection of plane, sketching, applying features, visualization and exporting/saving)
	2.4. Parts are properly assembled using Assemble parts template tools (importing parts, mating parts, export/save the mated parts)

	2.5. Drawing is properly produced based on required layout requirements (sheet size and orientation, scale, title block, needed views and details, visualization, etc..)
	2.6. Drawing is correctly exported according to the required format
3. Use MULTISIM Software	3.1. MULTISIM Software is correctly installed based on software's minimum system requirements and installation process.
	3.2. User interface is correctly customized based on the project to be designed
	3.3. Project/object is appropriately designed based on the output
	3.4. Project/Circuit response is properly analysed based on Connected measuring instruments
	3.5. Circuit PCB is properly designed based on project/circuit output
	3.6. Work done is appropriately exported based on the required format.

Course content

Learning outcomes	At the end of the module the learner will be able to: 1. Use AutoCAD Software 2. Use SolidWorks Software 3. Use MULTISIM Software

Learning outcome 1: Use AutoCAD Software	Learning hours: 22

Indicative content

- **Installing AutoCAD**
  - ✓ Introduction to AutoCAD
    - Definition
    - Application/Use
    - Versions
    - Advantages and limitations
    - Minimum computer system requirements
  - ✓ Installation of AutoCAD
    - Setup access and methods of installation (Download from online installer, Windows AutoCAD installer, Windows Autodesk installer)
    - Installation wizard
    - Activation
  - ✓ Basic commands to confirm proper installation
    - Starting the Software
    - Manipulation to AutoCAD interface

- Saving work

- **Customizing AutoCAD working space**
  - ✓ User interface
    - Menu bar
    - Ribbon
    - Layout tab
    - User Coordinate System (UCS)
    - Command line
    - Status bar
  - ✓ Tools bars
  - ✓ Tool palettes
  - ✓ AutoCAD Workspace
    - 2D drafting and annotation,
    - Initial Setup workspace,
    - AutoCAD Classic
    - 3D Modeling.

- **Creating layers**
  - ✓ Definition
  - ✓ Use of layers
  - ✓ Creation of layers
  - ✓ Layer manipulation
    - Control layer properties (on, freeze, lock, line type, line size and color, etc…)

- Making layer current

- **Creation of Geometric Objects**
  - ✓ Selection of a layer
  - ✓ Setting of units for measurements and angles
  - ✓ Creation of object
    - From Command line
    - From ribbon
    - From Draw tool bars
    - From tool palettes
  - ✓ Using precision tools (snap, grid, Orth, etc…)
  - ✓ Viewing properties of drawn object
  - ✓ Analyse 2D drawing
    - Using measure geometry commands
    - Length measurement
    - Area calculation
  - ✓ Saving and exporting the project
- **Modifying geometric object**
  - ✓ Level 1 modify commands
  - ✓ Level 2 modify commands
- **Application of Annotations to the drawing**
  - ✓ Notes and labels;
  - ✓ Tables;

- ✓ Dimensions;
- ✓ Hatches;
- ✓ Blocks.

- **Plotting a Drawing**
  - ✓ Choosing layout page
  - ✓ Setting up a page
  - ✓ Creating viewpoint
  - ✓ Floating model space
  - ✓ Scaling view point image
  - ✓ Locking a view point
  - ✓ Hatching scaling to paper
  - ✓ Plotting

Resources required for the learning outcome	
Equipment	▪ Computer ▪ projector
Materials	▪ Flip chat ▪ Papers ▪ Templates
Tools	▪ Marker pen ▪ AutoCAD Software ▪ Flash Disk
Facilitation techniques or Learning activity	▪ Demonstration ▪ Individualised method ▪ Simulations

	▪ Group discussion ▪ Trainer guided Practical exercises
Formative assessment methods /(CAT)	▪ Written evidence ▪ Oral presentation ▪ Performance evidence ▪ Product evidence

Learning outcome 2: Use SolidWorks Software	Learning hours: 23

Indicative content

- **Installing of SolidWorks**
  - ✓ Introduction to SolidWorks
    - Definition
    - Use
    - Versions
    - Advantages and limitations
    - Minimum computer system requirements
  - ✓ Installation of SolidWorks
    - Setup access and methods of installation
    - Installation wizard
    - Activation
  - ✓ Basic commands to confirm proper installation
    - Starting the Software
    - Manipulation of SOLIDWORK Interface
    - Saving and exporting the project
- **Customizing SolidWorks working space**
  - ✓ Choosing template
  - ✓ User interface in each template
    - Toolbars and Menus
    - Keyboard Shortcuts
    - Mouse Gestures
    - Command Manager Customization
    - Shortcut Bars
    - Custom Colours and Themes
    - Workspace Customization
    - File Locations
    - Custom Property Tab Builder
- **Drawing Part Object**
  - ✓ Selection of plane,

- Standard plane
- Custom plane

✓ Sketching

- 2D sketch
- Sketch tools
- Sketch entities
- Sketch relations
- Status of a Sketch (Full defined, Under defined, Over defined)

✓ Applying features

- Extruded boss
- Extruded cut
- Revolved boss
- Revolved cut
- Swept boss
- Lofted boss
- Fillet
- Chamfer
- Rib
- Shell
- Linear pattern
- Circular pattern
- Mirror

✓ Visualization

- Material
- Appearance
- Scene and environment
- View orientation
- Display style
- Lighting
- Camera setting
- Evaluate

- ✓ Exporting/saving

- **Assembling Parts**
  - ✓ Importing parts
    - Make assembly from a part
    - Browsing components
  - ✓ Mating
    - Standard mates
    - Advanced mates
    - Mechanical mates
    - Analysis
  - ✓ Export /save
- **Production of Drawing**
  - ✓ Setting drawing sheet layout
    - Size
    - Orientation
    - Scale
  - ✓ Inserting a title block
  - ✓ Import and arrangement of needed views and details,
  - ✓ Visualization
- **Plotting a Drawing**
  - ✓ Choosing layout page
  - ✓ Setting up a page
  - ✓ Creating viewpoint
  - ✓ Floating model space
  - ✓ Scaling view point image
  - ✓ Locking a view point
  - ✓ Hatching scaling to paper
  - ✓ Plotting

Resources required for the indicative content	
Equipment	▪ Computer

	▪ Projector
Materials	▪ Flip chat ▪ Papers ▪ Templates
Tools	▪ Marker pen ▪ Solidworks Software
Facilitation techniques or Learning activity	▪ Demonstration ▪ Individualised method ▪ Simulations ▪ Group discussion ▪ Trainer guided ▪ Practical exercises
Formative assessment methods /(CAT)	▪ Written evidence ▪ Oral presentation ▪ Performance evidence ▪ Product evidence

Learning outcome 3: Use MULTISIM Software	Learning hours: 15
Indicative content	

- **Installation process of MULTISIM Software**
  - ✓ Introduction to MULTISIM
    - Definition
    - Use
    - Versions
    - Advantages and limitations
    - Minimum computer system requirements
  - ✓ Installation of MULTISIM software

- Setup access and methods of installation
- Installation wizard
- Activation
- Update and register (Optional)

- **Customizing MULTISIM Software user interface**
  - ✓ Ribbon menu
    - File tab
    - Edit tab
    - View tab
    - Simulate tab
    - Instruments tab
  - ✓ Workspace
  - ✓ Component browser
  - ✓ Instruments and virtual instruments
  - ✓ Connector panel
  - ✓ Status bar
  - ✓ Navigation tool
  - ✓ Simulation controls
  - ✓ Grapher
  - ✓ Analysis probes
  - ✓ Project explorer
  - ✓ Setting and options
- **Designing/Creating and managing object/Drawing**
  - ✓ New project through menu bar
  - ✓ New circuit through new circuit bar
  - ✓ Editing the circuit through properties, place new wire and delete bars
- **Analysing project/circuit response**
  - ✓ Connection of measuring instruments
    - Voltmeter
    - Ammeter
    - Frequency meter

- Tachometer
- Wattmeter
- Ohmmeter

✓ Connection of Oscilloscope to analyse response of the circuit

- **Designing PCB layout features**
  - ✓ Component placement
  - ✓ Routing
  - ✓ Copper pour
  - ✓ Design Rule Check (DRC)
  - ✓ Gerber file generator (GFG)
  - ✓ Layer management
  - ✓ Footprint library
  - ✓ 3D visualization
- **Producing Drawing**
  - ✓ Setting drawing sheet layout
    - Size
    - Orientation
    - Scale
  - ✓ Inserting a title block
  - ✓ Import and arrangement of needed views and details,
  - ✓ Visualization
  - ✓ Saving project in MULTISIM
    - Use save command
    - Use save As command
  - ✓ Exporting project in MULTISIM
    - Export to PDF
    - Export to Image
    - Export Netlist
    - Export graph
    - Export spice
    - Export BOM

Resources required for the indicative content	
Equipment	▪ Computer ▪ Projector
Materials	▪ Flip chat ▪ Papers ▪ Templates
Tools	▪ Marker pen ▪ AutoCAD Software
Facilitation techniques or Learning activity	▪ Demonstration ▪ Individualised method ▪ Simulations ▪ Group discussion ▪ Trainer guided ▪ Practical exercises
Formative assessment methods /(CAT)	▪ Written evidence ▪ Oral presentation ▪ Performance evidence ▪ Product evidence

References:

Books

1. Introduction to CAD/CAM 1."Computer Integrated Design and Manufacturing" by David Bedworth and Philip Wolfe
2. Fundamentals of CAD/CAM 1."Fundamentals Of Cad/Cam/Cim" by Sharma
3. Computer Aided Design of Machines 1."Computer-Aided Kinetics for Machine Design" by Daniel L Ryan and Una S Ryan
4. Computer Aided Design and Engineering 1."Computer Aided Process Plant Design" by Leesley M L

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3. https://www.autodesk.com/
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5. https://www.solidworks.com/product/students
6. https://en.wikipedia.org/wiki/NI_Multisim
7. https://www.multisim.com/content/9DqSigwz3dkSMgdXN8t4jT/online-simulator/
8. https://www.multisim.com/get-started/