

## General Objectives

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

- a) understand the concepts mechanical plants
- b) apply acquired knowledge to maintain mechanical plants
- c) appreciate quality control in mechanical engineering works
- d) observe safety measures when operating mechanical plant
- e) design projects, using the computer aided design packages
- f) manage a given plant effectively
- g) produce components using the foundry processes
- h) prepare and execute a trade project.

## Key Competencies

By the end of this module, the trainee should demonstrate ability to:

- Manage a Foundry Technology Workshop
- Manage a production line
- Design mechanical components using various computer programmes and soft wares
- Analyse machine performances

### 24.3.0 COMPUTER AIDED DESIGN (AUTOCAD)

#### 24.3.1 Introduction

Computer Aided design (CAD) involves the use of relevant computer software to design and draw engineering components. The module unit will impart the trainee with the competencies required to use the computer software to design, develop draw and animate design features.

The instructional approach will lay emphasis on practical and project work. The recommended mode of assessment for the module unit is theory and practical tests, assignment or project. The trainee will be

required to have knowledge of Engineering drawing and design, Computer packages, Mechanical Technology and Engineering mathematics I and II of this course to enhance their understanding of the content of the module unit.

### 24.3.2 General Objectives

By the end of the module unit the trainee should be able to:

- a) understand the principle and use of computers to design and draw engineering components
- b) apply the relevant design software to produce a drawing
- c) operate various computer design systems used in Auto CAD.

### 24.3.3 Module Unit Summary and Time Allocation

#### COMPUTER AIDED DESIGN (AUTOCAD)

Code	Sub-Module Unit	Content	Time Hrs
24.3.01	Introduction to AutoCAD	<ul style="list-style-type: none"> <li>• Communication:</li> <li>• Advantages</li> <li>• Interpretation</li> <li>• Technology</li> </ul>	6
24.3.02	Starting AutoCAD	<ul style="list-style-type: none"> <li>• Starting AutoCAD</li> <li>• Creating an AutoCAD drawing</li> <li>• Saving an AutoCAD drawing</li> <li>• Opening an AutoCAD drawing</li> </ul>	6
24.3.03	AutoCAD Interface Customization	<ul style="list-style-type: none"> <li>• Drawing tools</li> <li>• Object snap tools</li> <li>• Polar tracking</li> <li>• Dimension styles</li> <li>• Zoom tool</li> </ul>	8
24.3.04	Drawing and Modifying Tools	<ul style="list-style-type: none"> <li>• Drawing tools</li> <li>• Modifying tools</li> </ul>	4
24.3.05	Layers and Object Properties	<ul style="list-style-type: none"> <li>• Layers</li> <li>• Object properties</li> </ul>	4
24.3.06	Drawing & Editing 2D Geometric	<ul style="list-style-type: none"> <li>• AutoCAD scale</li> <li>• Draw tools and menu</li> </ul>	6

	Objects	<ul style="list-style-type: none"> <li>• Modify tools and Menu</li> <li>• Command line</li> <li>• Zoom and Pan</li> </ul>	
24.3.07	Dimensioning and Texting	<ul style="list-style-type: none"> <li>• Types of dimensioning tools</li> <li>• Dimension style manager</li> <li>• Texting</li> </ul>	6
24.3.08	Hatching and Shading	<ul style="list-style-type: none"> <li>• Hatch methods</li> <li>• Hatch edit</li> </ul>	4
24.3.09	Isometric Drawing	<ul style="list-style-type: none"> <li>• Drawing an isometric circle</li> <li>• Drawing an isometric object</li> </ul>	6
24.3.10	Assembly Drawing and Sectioning	<ul style="list-style-type: none"> <li>• Assembly</li> <li>• Sectioning</li> </ul>	18
24.3.11	3D Modeling	<ul style="list-style-type: none"> <li>• 3D Modelling planes</li> <li>• Modelling methods</li> <li>• Editing methods</li> </ul>	6
24.3.12	Creating Elevations	<ul style="list-style-type: none"> <li>• Elevation extraction</li> <li>• Use of viewpoints</li> </ul>	6
24.3.13	Shading & Rendering	<ul style="list-style-type: none"> <li>• Shading</li> <li>• Rendering</li> <li>• Raster images</li> </ul>	4
24.3.14	Laying Out and Plotting	<ul style="list-style-type: none"> <li>• Plot layout</li> <li>• Plotter setting</li> <li>• Plotting</li> </ul>	4
	<b>Total Time</b>		88

### 24.3.01 INTRODUCTION TO AUTOCAD

#### Theory

24.3.01T0 *Specific Objectives*  
By the end of the sub-module unit, the trainee should be able to:

a) communicate ideas through the use of AutoCAD s

- software as a drawing media
- b) outline advantages of AutoCAD as a drafting software
- c) read and interpret AutoCAD working drawings
- d) accommodate new technological changes in drawing

24.3.01C *Competence*

	The trainee should have the ability to read and interpret AutoCAD working drawings		b) create, save and open a drawing
24.3.01T1	<p><i>Content:</i></p> <p>Communication</p> <ul style="list-style-type: none"> <li>- Design</li> <li>- Drafting</li> <li>- documentation</li> </ul>	24.3.02C	<p><i>Competence</i></p> <p>The trainee should have the ability to create, save and open an AutoCAD file.</p>
24.3.01T2	<p>Advantages</p> <ul style="list-style-type: none"> <li>- Accuracy</li> <li>- Consistency</li> <li>- Easy storage and retrieval</li> <li>- Networking</li> <li>- Easy amendment</li> </ul>	24.3.02P1	<p><i>Content</i></p> <p>Starting AutoCAD</p>
24.3.01T3	Interpretation	24.3.02P2	Creating an AutoCAD drawing
24.3.01T4	<p>Technology</p> <ul style="list-style-type: none"> <li>- New technology</li> </ul> <p><i>Suggested Learning Resources</i></p> <ul style="list-style-type: none"> <li>- Computer installed with AutoCAD</li> <li>- textbook</li> <li>- Autodesk website:www.autodesk.com</li> </ul>	24.3.02P3	Saving an AutoCAD drawing
		24.3.02P4	Opening an AutoCAD drawing
			<p><i>Suggested Learning Resources</i></p> <ul style="list-style-type: none"> <li>- Computer installed with AutoCAD</li> <li>- textbook</li> <li>- Autodesk website:www.autodesk.com</li> </ul>
		<b>24.3.03</b>	<b>AUTOCAD INTERFACE CUSTOMIZATION</b>
<b>24.3.02</b>	<b>STARTING AUTOCAD</b>		<b>Practice</b>
	<b>Practice</b>		
24.3.02P0	<p><i>Specific Objectives</i></p> <p>By the end of the sub-module unit, the trainee should be able to:</p> <p>a) start AutoCAD program</p>	24.3.03P0	<p><i>Specific Objectives</i></p> <p>By the end of the sub-module unit, the trainee should be able to:</p> <p>a) activate the tool bars, object snap and polar tracking</p> <p>b) set the required dimension styles</p>

24.3.03C *Competence*  
The trainee should have the ability to set up a drawing environment necessary for the work

*Content*

24.3.03P1 Drawing tools  
24.3.03P2 Object snap tools  
24.3.03P3 Polar tracking  
24.3.03P4 Dimension styles

*Suggested Learning Resources*

- Computer installed with AutoCAD
- textbook
- Autodesk website:www.autodesk.com

**24.3.04 DRAWING AND MODIFYING TOOLS**

**Practice**

*Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

- identify and use the drawing tools
- identify and use the modifying tools

24.3.04C *Competence*  
The trainee should have the ability to: use the drawing and modifying tools

*Content*

24.3.04P1 Drawing tools

- Line
- Rectangle
- Circle
- Arc
- Text
- Spline
- Construction line
- Polyline
- Make block
- Insert block
- Point
- Hatch
- Region

24.3.04P2 Modifying tools

- Offset
- Copy
- Mirror
- Erase
- Array
- Break
- Fillet
- Chamfer
- Explode
- Scale
- Trim
- Extend
- stretch
- Move

*Suggested Learning Resources*

- Computer installed with AutoCAD
- textbooks
- Autodesk website:www.autodesk.com

**24.3.05 LAYERS AND OBJECT PROPERTIES**

	<b>Practice</b>		<b>Practice</b>
24.3.05P0	<p><i>Specific Objectives</i> By the end of the sub-module unit, the trainee should be able to:</p> <ol style="list-style-type: none"> <li>a) create layers relevant to a given drawing</li> <li>b) apply and edit layers.</li> </ol>	24.3.06P0	<p><i>Specific Objectives</i> By the end of the sub-module unit, the trainee should be able to:</p> <ol style="list-style-type: none"> <li>a) draw 2D objects to a scale of 1:1</li> <li>b) edit the drawing properties 2D objects</li> </ol>
24.3.05C	<p><i>Competence</i> The trainee should have the ability to create and apply layers relevant to a given drawing</p>	24.3.06C	<p><i>Competence</i> The trainee should have the ability to produce and edit mechanical drawings in 2D</p>
24.3.05P1	<p><i>Content</i> Layers</p> <ul style="list-style-type: none"> <li>- Name</li> <li>- On</li> <li>- Freeze</li> <li>- Lock</li> <li>- Color</li> <li>- Plot style</li> </ul>	24.3.06P1	<p><i>Content</i> Drawing in 2D</p> <ul style="list-style-type: none"> <li>- AutoCAD scale</li> <li>- Draw tools and menu</li> <li>- Modify tools and Menu</li> <li>- Command line</li> <li>- Zoom and Pan</li> </ul>
24.3.05P2	<p>Object properties</p> <ul style="list-style-type: none"> <li>- Line type</li> <li>- Line weight</li> <li>- Line color</li> </ul> <p><i>Suggested Learning Resources</i></p> <ul style="list-style-type: none"> <li>- Computer installed with AutoCAD</li> </ul>		<p><i>Suggested Learning Resources</i></p> <ul style="list-style-type: none"> <li>- Textbooks</li> <li>- Computer lab</li> <li>- Internet</li> <li>- Autodesk website: <a href="http://www.autodesk.com">www.autodesk.com</a></li> </ul>
<b>24.3.06</b>	<b>DRAWING &amp; EDITING 2D GEOMETRIC OBJECTS</b>	<b>24.3.07</b>	<b>DIMENSIONING AND TEXTING</b>
			<b>Practice</b>

24.3.07P0 *Specific Objectives*  
By the end of the sub-module unit, the trainee should be able to:

- apply and edit various dimensioning tools
- use dimensioning tools to edit a drawing
- use dimensioning style manager

- Extend beyond dim line
- Tolerances
- Texting
  - o single line text
  - o multiple line text
  - o text editing
  - o style
  - o height
  - o color

*Suggested Learning Resources*

- Textbooks
- Computer lab
- Internet
- Autodesk website:www.autodesk.com

24.3.07C *Competence*  
The trainee should have the ability to produce a fully labelled and dimensioned drawing

**24.3.08**

**HATCHING AND SHADING**

*Content*

24.3.07P1 Dimensioning  
24.3.07P2 Dimensioning tools

- Linear
- Aligned
- Ordinate
- Radius
- Diameter
- Angular
- Leader
- Tolerance
- Center mark

24.3.07P3 Dimension style manager

- Text
- Lines and arrows
- Primary units
- Offset from origin

**Practice**

24.3.08P0 *Specific Objectives*  
By the end of the sub-module unit, the trainee should be able to:

- apply drawing hatches
- edit applied hatches

24.3.08C *Competence*  
The trainee should have the ability to hatch a drawing using various hatch patterns

*Content*

24.3.08P1 Hatch methods

24.3.08P2	<ul style="list-style-type: none"> <li>- Pick point</li> <li>- Select objects</li> </ul> Hatch edit <ul style="list-style-type: none"> <li>- Scale</li> <li>- Spacing</li> <li>- Angle</li> <li>- pattern</li> </ul>	<ul style="list-style-type: none"> <li>- Snap and grid tab</li> <li>- Ellipse</li> <li>- Iso-circle</li> <li>- Drawing an isometric object</li> </ul>	
	<p><i>Suggested Learning Resources</i></p> <ul style="list-style-type: none"> <li>- Textbooks</li> <li>- Computer lab</li> <li>- Internet</li> <li>- Autodesk website:www.autodesk.com</li> </ul>	<p><i>Suggested Learning Resources</i></p> <ul style="list-style-type: none"> <li>- Textbooks</li> <li>- Computer lab</li> <li>- Internet</li> <li>- Autodesk website:www.autodesk.com</li> </ul>	
<b>24.3.09</b>	<b>ISOMETRIC DRAWING</b>	<b>24.3.10</b>	<b>ASSEMBLY DRAWING AND SECTIONING</b>
	<b>Practice</b>		<b>Practice</b>
24.3.09P0	<p><i>Specific Objectives</i></p> By the end of the sub-module unit, the trainee should be able to: <ol style="list-style-type: none"> <li>a) use the snap and grid tab to set the isometric plane</li> <li>b) draw an isometric circle using an ellipse</li> <li>c) draw pictorial views in isometric</li> </ol>	24.3.10P0	<p><i>Specific Objectives</i></p> By the end of the sub-module unit, the trainee should be able to: <ol style="list-style-type: none"> <li>a) assemble exploded parts of a component</li> <li>b) section and hatch an assembled drawing</li> </ol>
24.3.09C	<p><i>Competence</i></p> The trainee should have the ability to produce pictorial views	24.3.10C	<p><i>Competence</i></p> The trainee should have the ability to assemble and section an exploded component
24.3.09P1	<p><i>Content</i></p> Drawing an isometric circle	24.3.10P1	<p><i>Content</i></p> Assembly <ul style="list-style-type: none"> <li>- Union</li> </ul>



24.3.10P2	<ul style="list-style-type: none"> <li>- Extrusion</li> <li>- Sectioning</li> <li>- Section</li> <li>- Slice</li> </ul> <p><i>Suggested Learning Resources</i></p> <ul style="list-style-type: none"> <li>- Textbooks</li> <li>- Computer lab</li> <li>- Internet</li> <li>- Autodesk website:www.autodesk.com</li> </ul>	24.3.11P2	<ul style="list-style-type: none"> <li>- SW</li> <li>- Modeling methods</li> <li>- Solids</li> <li>- Extrusion</li> <li>- Revolve</li> </ul>
		24.3.11P3	<p>Editing methods</p> <ul style="list-style-type: none"> <li>- 3D Rotation</li> <li>- 3D Mirroring</li> <li>- 3D array</li> <li>- 3D fillet</li> <li>- 3D chamfer</li> </ul> <p><i>Suggested Learning Resources</i></p> <ul style="list-style-type: none"> <li>- Textbooks</li> <li>- Computer lab</li> <li>- Internet</li> <li>- Autodesk website:www.autodesk.com</li> </ul>
<b>24.3.11</b>	<b>3D MODELING</b>		
	<b>Practice</b>		
24.3.11P0	<p><i>Specific Objectives</i></p> <p>By the end of the sub-module unit, the trainee should be able to:</p> <ol style="list-style-type: none"> <li>a) understand the 3D modeling planes</li> <li>b) model objects in 3D</li> <li>c) edit a 3D object</li> </ol>	<b>24.3.12</b>	<b>CREATING ELEVATIONS</b>
			<b>Practice</b>
24.3.11C	<p><i>Competence</i></p> <p>The trainee should have the ability to model components in 3D to specified dimensions</p>	24.3.12P0	<p><i>Specific Objectives</i></p> <p>By the end of the sub-module unit, the trainee should be able to:</p> <ol style="list-style-type: none"> <li>a) extract elevations from a 3D model</li> <li>b) use viewpoints to illustrate plan, end and front elevations.</li> </ol>
24.3.11P1	<p><i>Content</i></p> <p>3D modeling planes</p> <ul style="list-style-type: none"> <li>- SE</li> <li>- NE</li> <li>- NW</li> </ul>	24.3.12C	<p><i>Competence</i></p> <p>The trainee should have the ability to draw in either 1<sup>st</sup> angle</p>

	or 3 <sup>rd</sup> triangle projections		The trainee should have the ability to:
	<i>Content</i>		i) Produce a shaded a model
24.3.12P1	Extracting elevations		ii) Produce a realistic image of a model
	- Plan		
	- Front		
	- End		
24.3.12P2	Use of viewpoints	24.3.13P1	<i>Content</i>
	- Named viewpoints		Shading modes
			- 3D wireframe
			- Hidden
			- Flat shaded
			- Gouraud shaded
			- Flat shaded edges on
			- Gouraud shaded, edges on
	<i>Suggested Learning Resources</i>	24.3.13P2	Library textures
	- Textbooks		- Modify
	- Computer lab		- Attach
	- Internet	24.3.13P3	Rendering environment
	- Autodesk website:www.autodesk.com		- Light
<b>24.3.13</b>	<b>SHADING &amp; RENDERING</b>		- Mapping
	<b>Practice</b>		- Background
24.3.13P0	<i>Specific Objectives</i>	24.3.13P4	- Landscape
	By the end of the sub-module unit, the trainee should be able to:		Rendering types
	a) shade a 3D model using various shading modes		- Photo real render
	b) apply various library textures for rendering		- Photo raytrace
	c) enhance and regulate the rendering environment		<i>Suggested Learning Resources</i>
	d) render a 3D model in photo-real type		- Textbooks
		<b>24.3.14</b>	- Computer lab
			- Internet
			- Autodesk website:www.autodesk.com
24.3.13C	<i>Competence</i>		<b>LAYING OUT AND PLOTTING</b>
			<b>Practice</b>

24.3.14P0	<p><i>Specific Objectives</i></p> <p>By the end of the sub-module unit, the trainee should be able to:</p> <p>a) create a layout for plotting</p> <p>b) set a plotter for plotting</p> <p>c) plot a drawing</p>	24.3.14P2	<ul style="list-style-type: none"> <li>- Plot device</li> <li>- Paper orientation</li> <li>- Layout Settings</li> </ul> <p>Plotter setting</p> <ul style="list-style-type: none"> <li>- Paper type</li> <li>- Paper feed</li> <li>- Plotting</li> </ul> <p><i>Suggested Learning Resources</i></p> <ul style="list-style-type: none"> <li>- Textbooks</li> <li>- Computer lab</li> <li>- Internet</li> <li>- Autodesk website: <a href="http://www.autodesk.com">www.autodesk.com</a></li> </ul>
24.3.14C	<p><i>Competence</i></p> <p>The trainee should have the ability to prepare a drawing for plotting</p>		
	<p><i>Content</i></p>		
24.3.14P1	Plot layout		

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## 25.3.0 THERMODYNAMICS

### 25.3.1 Introduction:

The module unit is designed to equip the trainee with knowledge, skills and attitudes in the field of thermodynamics. Thermodynamics deals with the relationships of work, heat and energy.

The instructional approach will emphasize on experiments, industrial visits and analysis of various engineering concepts.

### 25.3.2 General Objectives:

By the end of these module units, the trainee should be able to: