

Course name:	MECHANICAL 1
Short name:	MECH 1
Length:	200 hrs
Prerequisites:	Working skills in four-function math including whole numbers, signed numbers, decimals and fractions. The ability to solve simple linear equations is also required. (Remediation is available.)

Purpose

This course provides the knowledge and hand skills needed to form the foundation for ongoing mechanical training. Engineers performing equipment design or modification gain much practical knowledge in this course.

Description

This course provides training in four areas: workshop practice and safety, technology, math, and drawing. This course will provide an understanding of industry standards, work methods, and practices.

Topics include:

- Safety
- Drawing technology
- Drawing rectangular, sloped, & round parts
- Visualization of detail parts
- Basic assembly drawing analysis
- Use of the drawing package
- Foreign language drawings
- Work methods (following & writing)
- Lubrication, seals, & gaskets
- Couplings
- Fasteners and thread designations
- Gear, belt, and chain drives
- Bearings and bushings
- Surface finish
- Tolerances & fits (ISO & geometric)
- Conveyors
- Hand skills plus layout techniques
- Drilling, tapping, reaming, broaching
- Hands-on machine assembly
- Coupling alignments
- Precision measuring
- Basic trade math - through algebra
- Metric measurement

Course Objectives:

Upon the successful completion of this course, the trainee will be competent in:

- General safety procedures as they relate to shop, tools, and equipment.
- Analyzing mechanical drawings in both 1st and 3rd angle view.
- Recognizing, identifying, and explaining function, failures, and proper installation of mechanical components and their usage: belts, pulleys, clutches, fasteners, gears, seals, and bearings.
- Applying tolerances, fits, and bearing theory.
- Using precision measuring devices to verify proper machine setup.
- Performing mathematical functions as they apply to mechanical theory.
- Selecting proper lubrication for specific application.
- Aligning and tensioning or adjusting drive systems.

Course name:	MECHANICAL 2
Short name:	MECH 2
Length:	160 hrs
Prerequisites:	MECH 1 Working skills in four-function math including whole numbers, signed numbers, decimals and fractions. The ability to solve simple linear equations is also required. (Remediation is available.)

Purpose

This course provides a foundation for mechanical skills in the topics listed below.

Description

Assembly print reading and the in-depth analysis of mechanical assemblies.
 Assembly skills needed to properly build and adjust mechanisms.
 Practical application of tools and metrology needed to obtain proper fits and alignments.

Topics include:

- Gear drives
- Cumulative tolerance
- Bearing technology
- Right angle trigonometry
- Sling calculations (Vectors)
- Levers and torque
- Simultaneous equations
- Metals technologies incl. AISI standards
- Heat treatment
- Hardness testing
- Assembly drawing analysis
- Work method development
- Work method implementation
- Hands-on machine assembly
- Coupling alignment

Course Objectives:

Upon successful completion of this course, the trainee will be competent in:

- General safety procedures as they relate to shop, tools, and equipment.
- Analyzing mechanical drawings in both 1st and 3rd angle view.
- Recognizing, identifying, and explaining function, failures, and proper installation of mechanical components and their usage: belts, pulleys, clutches, fasteners, gears, seals, and bearings.
- Applying tolerances, fits, and bearing theory.
- Using precision measuring devices to verify proper machine setup.
- Performing mathematical functions as they apply to mechanical theory.
- Accurately assembling a machine using assembly drawings and be able to analyze and repair as needed.
- Identifying different material designations and cross reference between American and European designations.
- Different heat treatment processes performed on metals.
- Recognizing and verifying different hardness designations.

Course name:	BEARINGS
Short name:	M108
Length:	16 hrs
Prerequisites:	None

Purpose

This course provides the knowledge of the more common bearings, their identification, terminology, general care, and handling.

Description

This course is a classroom introduction to bearings identifying types, their function, and application. The practical use of bearing catalogues for reference to load rating, speed, and type of lubrication are also discussed.

Topics include:

- Classification
- Terminology
- Type (friction/anti-friction)
- Speed
- Drawing symbols
- Loads
- Number designation (code)
- Symbols
- X + O configuration
- Bearing recognition

Course Objectives:

Upon successful completion of this course the trainee will be competent in:

- Identifying any standard type of bearing; know its load types, and application.
- Investigating a machine or drawings for a machine and determine how the bearings are properly removed and installed.
- Inspecting bearing seats on shaft and housing and determine if correct sizes for proper fit.
- Proper storage and handling of bearings.
- Using the proper equipment & technique to install and remove bearings.
- Lubricating bearings.
- Inspecting a bearing in hand and analyze a bearing when it is running to determine if the bearing is faulty.
- Setting internal clearance in taper roller bearings and taper bore bearings.

Course name:	CHAIN DRIVES
Short name:	M401
Length:	8 hrs
Prerequisites:	None

Purpose

This course provides the knowledge of chain driven systems, transmission of power, and conveyance of materials.

Description

This course provides the differences between standard roller chain and sprockets in both British and American Standard along with practical exercises in sprocket alignment, chain adjustment, and speed calculations.

Topics include:

- Types of chains
- Chain adjustment
- Types of sprockets
- Chordal action
- Numbers & codes
- Lubrication
- Operating guidelines
- Installation & maintenance
- Chain wrap
- Wear recognition

Course Objectives:

Upon successful completion of this course, the trainee will be competent in:

- Identifying any standard type of chain & characteristics.
- Detach and install a chain.
- Identifying a type of sprocket, aligning and matching the sprocket and chain.
- Identifying connecting links and installing them properly.
- Setting proper chain tension.
- Analyzing chain and sprocket wear and knowing wear limits.
- Chain and sprocket lubrication.
- Identifying chain tensioners and their application.

Course name: CONVEYOR SYSTEMS

Short name: M302

Length: 8 hrs

Prerequisite: None

Purpose

This course provides the knowledge of the different types of conveyor systems and the ability to perform basic maintenance on conveyor systems. The trainee will be able to maintain, track and adjust conveyor belt systems.

Description

This course consists of instruction on conveyor components and their significance, belting types and construction, application of flat or inclined drives, and methods of connecting conveyor belting. Practical applications of belt installation and belt tracking are taught.

Topics include:

- Drive or head pulley
- Misalignment
- Carrier troughing rollers
- Tracking
- Snub pulleys
- Loading
- Self aligning idlers

Course Objectives:

Upon successful completion of this course the trainee will be competent in:

- Identifying the various types of conveyors.
- Identifying the most common types of conveyor belts and their characteristics.
- Identifying the components of a conveyor belt assembly and know the function of each.
- Identifying the types of conveyor belt splices and the characteristics of each.
- Inspecting a conveyor belt for camber and squareness of joint and knowing the limit of each.
- Checking and maintain the alignment of the frame and conveyor components.
- Installing a conveyor belt and adjusting it to the proper tension.
- Reciting the rule for tracking and be able to track a conveyor belt (two directional).

Course name:	LUBRICATION
Short name:	M300
Length:	8 hrs
Prerequisites:	None

Purpose

This course provides the terminology, method of application, types, and uses of lubricants.

Description

This course is an introduction to the basic types of lubricants, their properties, terms used in lubrication, and various methods of applying lubricants with emphasis on cleanliness. (Supported by video.)

Topics include:

- Definitions
- Types of friction
- Function
- Storage
- Types & categories
- Oils & grease
- Application methods

Course Objectives:

Upon successful completion of this course the trainee will be competent in:

- The terms associated with lubrication like adhesion, cohesion, viscosity, viscosity index, flash point consistency etc.
- Using a lubrication manual from a leading lubricant manufacture and select the proper lubricant for a particular machine and the job that it is doing.
- Applying the proper quantity of lubricant to the machine and using the proper lubrication method.

Course name:	MEASUREMENT & LAYOUT
Short name:	M105
Length:	16 hrs
Prerequisite:	None

Purpose

This course provides the knowledge and skill of measurement and layout instruments and their application.

Description

The course begins with a brief history of measurement, then from linear, through comparison, to accurate measurement instruments, concluding with different methods of layout.

Topics include:

- Measurement
- Non-precision measuring tools
- Precision measuring tools
- Direct reading & transfer type instruments
- Gauging instruments
- Layout

Course Objectives:

Upon successful completion of this course the trainee will be competent in:

- Working effectively with the metric system in linear measurement.
- Taking accurate measurements with the following instruments:
 - Rule
 - Feeler gauge
 - Vernier caliper
 - Micrometer caliper
 - Small-hole gauge
 - Telescopic gauge
 - Vernier protractor
 - Inside Micrometer
 - Screw pitch gauge
 - Building up of gauge blocks to specific size
 - Using dial indicators to check measurements
 - Laying out outlines of parts with layout tools such as scribes, squares, dividers, height gauges, angle plates, center heads, “V” blocks, etc.

Course name:	METRIC MEASUREMENT
Short name:	M100
Length:	8 hrs
Prerequisite:	None

Purpose

This course is an introduction to Metric measurement systems.

Description

This course provides the definitions of the various Metric units of measure, the practical applications, calculations and expressions.

Topics include:

- Metric system
- Derived Metric units
- Base units of length, etc.
- Metric, imperial conversion
- Prefixes
- Working with the Metric system

Course Objectives:

Upon successful completion of this course the trainee will be competent in:

- Recognizing a metric base unit of measure and a derived metric unit.
- Recognizing the prefixes associated to metric units.
- Converting from one prefix to another within a base unit.
- Hands-on appreciation for the more common units. Ex: visualize the length of a centimeter, have a feel for the mass of a kilogram or recognize the volume of a liter.
- Expressing measurements of length, mass, time and temperature in the metric system.
- Conversion of some of the common units from imperial to metric and metric to imperial.

Course name:	PRINT READING BASIC
Short name:	M102
Length:	40 hrs
Prerequisites:	None

Purpose

This course provides the knowledge required to read mechanical drawings in various languages and standards.

Description

This course covers drafting techniques, standards and generalities of mechanical drawings, as well as an overview of bill of materials and assembly drawings. Activities include reading and producing basic detail drawings.

Topics include:

- Familiarization with drafting tools and techniques
- Technology of lines
- Quality of lines and identification
- Part visualization and orthogonal viewing
- View projection
- First angle views: International and US standards
- View representation
- Shapes and sizes
- Explanation of pictorial drawings
- Recognition of Isometric, Oblique, and Perspective drawings
- Producing a simple detail drawing with dimensions
- Title block development
- Interpretation of curved surfaces
- Dimensioning generalities
- Dimensioning cylinders
- Dimensioning prisms
- Dates and revision control
- Content of a drawing number
- Modifications
- Bill of materials, assembly and detail drawings
- Foreign language terminology (customer's choice)
- Mechanical print reading assignments

Course Objectives:

Upon successful completion of this course the trainee will be competent in:

- Producing a complete detail drawing of a mechanical component in 1st angle projection.
- Reading nomenclature drawings (parts lists) to obtain a complete list of mechanical components both engineered and purchased.
- Reading a detail drawing to understand exactly a particular part. The material it's made of, its size, shape, tolerance, surface finish, and heat treatment.
- Reading an assembly drawing without the use of section views and determining some of the information available. Including, number of parts, relationship of parts to each other, and to be able to freely move from one view to another and find a common feature.
- Analyzing the information in a title block and the meaning of each number in a drawing number.

Course name:	PRINT READING ADVANCED
Short name:	M303
Length:	40 hrs
Prerequisites:	M102

Purpose

This class provides the advanced knowledge of print reading skills to cover all aspects of mechanical drawings.

Description

This course will cover the finer points of detailed drawings and the production of “bill of materials”. Assembly drawings reading skills will assure the maximum information is obtained from the drawing. CenTec will provide drawings; however, your company’s drawings are recommended.

Topics include:

- Symmetry
- Geometric tolerances
- Section views
- Surface finish
- Auxiliary views
- Material specifications
- Partial views
- Fastener designations
- Tolerance of size
- Foreign language and other terminology and standards

Course Objectives:

Upon successful completion of this course the trainee will be competent in:

- Recognizing the types of section views and how they assist in reading a mechanical drawing.
- Recognizing the use of symmetry and what it represents.
- Reading a drawing that uses auxiliary views to describe a part or assembly.
- Recognizing the designations for fasteners, bearings, seals and materials and what they mean.
- Taking an assembly drawing and analyzing how the machine comes apart, how it goes together and how it Functions.

Course name:	RIGGING
Short name:	M109
Length:	8 hrs
Prerequisites:	None

Purpose

This course provides a familiarization with the safety aspect and principles applied to rigging.

Description

This course provides the terminology and methodology in choosing the correct lifting equipment for the application. Safety is stressed in all forms of lifting and lifting devices. The trainees will become familiar with the reference "Handbook for Riggers" as a guide to safe working practice in the work place.

Topics include:

- Lifting devices
- Slings
- Inspection
- Wire rope
- Practical exercises
- Working loads
- Steps in planning a rigging operation
- Rigging hardware

Course Objectives:

Upon successful completion of this course the trainee will be competent in:

- Calculating the weight of load and its center of gravity.
- Safety inspecting and using lifting devices such as lever hoists, chain hoists, drum hoists, electric hoists and pneumatic hoists.
- Safety inspecting, determining load ratings and using lifting devices such as shackles, spreaders, slings, turnbuckles, eyebolts, pulleys and hooks.
- Safely rigging a load and actually making a lift with the equipment covered in this course.

Course name:	SHAFT ALIGNMENT BASIC
Short name:	M113
Length:	8 hrs
Prerequisites:	None

Purpose

This course provides the knowledge of the effects of misalignment and the various methods for correction.

Description

This course provides the methods of shaft alignment using feeler gauge/straight edge and dial indicator. Trainees will align shafts on training modules in the shop using math formulae to within 0.05mm. Installation procedures are discussed as it relates to alignment.

Topics include:

- Alignment methods and accuracies of each
- Equipment installation “tips and pointers”
- Soft foot condition and how to correct it
- Coupling types and alignment requirements of each
- Straight edge / feeler gauge method of alignment
 - Calculation of shim requirements and machine offsets
- Dial indicator method of alignment
 - Tool set up for dial indicator method
 - Bar sag calculations and offsets
 - Calculations for shim requirements and machine offsets
- Proper clamping procedures to maintain alignment

Course Objectives:

Upon successful completion of this course the trainee will be competent in:

- Preparing a machine for alignment.
- Checking for soft-foot conditions.
- Doing a “straight-edge and feeler gauge” alignment to accuracy of 0.1mm.
- Doing a “dial indicator rim and face” alignment to accuracy of 0.05mm.
- Proper machine shimming and torquing.

Course name: SHAFT ALIGNMENT ADVANCED

Short name: M408

Length: 24 hrs

Prerequisites: M113

Purpose

This course provides advanced knowledge that includes additional methods, conditions, and related problems of alignment.

Description

This course provides additional alignment methods including reverse dial indicator and laser. The trainee will practice proper alignment procedures to within 0.02mm including reverse dial indicator.

Topics include:

- Installation of equipment, tips and pointers
- Straight edge / feeler gauge method review
- Soft foot condition and how to correct it
- Dial indicator method review
- Reverse dial indicator method of alignment
 - Calculation of shims and offsets by graph
 - Calculation of shims and offsets by calculator
 - Computer analysis of misalignment
 - Shims and offsets requirement
- Laser method of alignment
 - Set up of laser
 - Computer analysis of misalignment
 - Shims and offsets requirement
- Reverse dial versus laser, comparing advantages and disadvantages

Course Objectives:

Upon successful completion of this course the trainee will be competent in:

- All aspects of Shaft Alignment Basic (M113).
- Thermal growth calculations and alignment allowances for thermal growth.
- Doing a “reverse dial indicator” alignment to accuracy of 0.02mm.
- Doing a “laser” alignment to accuracy of 0.02mm.