

KMAT-0155 Advanced Mill

Author

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Competencies and Learning Objectives

1. Demonstrate cutting a keyway.
 - Prepare workpiece for cutting a keyway
 - Locate specifications for keyways
 - Cut keyway according to correct specifications
2. Demonstrate milling a worm wheel
 - Demonstrate milling gear teeth
 - Demonstrate broaching
3. Demonstrate detailing and lubricating a mill
 - Demonstrate cleaning a mill
 - Demonstrate dialing in a vice and tramming a mill head
 - Demonstrate lubricating a mill
4. Demonstrate squaring a workpiece
 - Demonstrate milling workpiece surfaces
 - Demonstrate rotating and clamping techniques
 - Demonstrate measuring workpiece for squaring
5. Demonstrate milling a clamp body
 - Use ball end mill to cut thumb groove
 - Determine drill sizes for tapped holes
 - Drill and tap holes
6. Demonstrate milling using a sine bar
 - Calculate required gauge block height using sine bar equation
 - Mill workpiece using sine bar
7. Demonstrate how to operate a radius end mill
 - Demonstrate using a radius end mill to create a radius on a workpiece

Course Description

This course will cover operation and performance of vertical knee mills in a machine shop lab setting.

Competencies

Upon completion of the course, you will be rated as MC (Mastered Competency) or NM (Not-Mastered Competency) based on ability to demonstrate the established competencies for the course. You will:

- Demonstrate cutting a keyway.
- Demonstrate milling a worm wheel.
- Demonstrate detailing and lubricating a mill.
- Demonstrate squaring a workpiece.
- Demonstrate milling a clamp body.
- Demonstrate milling using a sine bar.
- Demonstrate how to operate a radius end mill.

Assessment

During the course you be given written and performance exams.

Lab Final 1

Lab Final 2

Lab Final 3

Lab Final 4

Lab Final 5

Lab Final 6

Lab Final 7

Written Exam

You must pass with at least a score of 80% or higher on each summative assessment to be considered Master Competent and complete the course.

Course work

The course work for this class will be available partially online and partially in the lab. You will need to complete both the online and classroom portions to obtain the all of the course information.

Safety

In this course, you are expected to utilize safe behaviors and safety equipment for a machine shop. Safety will be evaluated in all performance exams.

Flexibility

If you feel that you are ready to do the lab final or exams without completing the course modules, please contact your instructor.



Contact and Assistance

If you need additional assistance with course material, you may consult with your instructor during open lab times Mon-Thur from 5pm to 9pm.

If you have questions about coursework outside of lab hours you may contact your instructor via text/voice 347-920-1047 or email darrell.smith@slcc.edu.

If you have technical issues with Internet access, computer labs, applications, BruinMail, Printing, or software navigate to <http://www.slcc.edu/student/help.aspx>

If you have technical issues with Canvas, navigate to <https://faculty.slcc.edu/elearning/canvas.aspx>

Syllabus

The expectations for this course are described in detail in the course syllabus. (Link to syllabus)

Course Navigation

In the left navigation bar is a Course Tools menu. It provides information about what tools you need for the course, and how to navigate in Canvas. Start the course with the first module below. You can also click on the Modules link in the left navigation bar to navigate through the course.

Modules

Module 1

Module 1: Overview

Introduction to the Module: This module will introduce you to cutting a keyway. You will have access to learning materials and activities including a video demonstration. Assessment of competencies in this module will take place in a lab final at the end of this module, and a written exam to be completed when you have completed modules 1-7.

The course work in this module, combined with class sessions should prepare you to:

Demonstrate cutting a keyway.

1. Prepare workpiece for cutting a keyway
2. Locate specifications for keyways
3. Cut keyway according to correct specifications

Module 1: Video Demonstrations

Watch the video titled: Cutting a Keyway

Information included in this video demonstration

1. [How to locate specifications for keyways](#)
2. [How to cut a keyway according to specifications](#)

Click this link to view the video.

Module 1: Lab Check in 1

Now that you have completed the learning materials for Module 1, check in with your instructor for more about Lab 1: Practice Keyways.

Module 1: Lab Final Check in 1

Now that you have completed the learning materials for Module 1 and Lab 1, check in with your instructor for more about Lab Final 1: Output Shaft.

Module 2

Module 2: Overview

Introduction to the Module: This module will introduce you to milling gear teeth and broaching. You will have access to learning materials and activities including a video demonstration. Assessment of competencies in this module will take place in a lab final at the end of this module, and a written exam to be completed when you have completed modules 1-7.

The course work in this module, combined with class sessions should prepare you to:

Demonstrate milling a worm wheel.

1. Demonstrate milling gear teeth
2. Demonstrate broaching

Module 2: Tooling U

The learning resources listed below will give you information about broaching. It is recommended that you complete all of the Tooling U modules listed below within one week. * Learning modules contain learning material, assignments and a practice quizzes.

Click here to enter Tooling U. *(Instructor uses materials and learning activities from this publisher)*

1. Chuck, Collets and Vises

*Note: Modules vary in length so budget your time wisely.

Module 2: Video Demonstrations

Watch the video titled: Broaching

Information included in this video demonstration

1. [How to broach using an Arbor Press](#)

Click this link to view the video.

Module 2: Lab 2 Check in

Now that you have completed the learning materials for Module 2, check in with your instructor for more about Lab 2: Practice Mill Gear Teeth and Broaching.

Module 2: Lab Final 2 Check in

Now that you have completed the learning materials for Module 2 and Lab 2, check in with your instructor for more about Lab Final 2: Mill Gear Teeth and Broach.

Module 3

Module 3: Overview

Introduction to the Module: This module will introduce you to the process of detailing and lubricating a Mill. You will have access to learning materials and activities including a video demonstration. Assessment of competencies in this module will take place in a lab final at the end of this Module, to be completed when you have completed modules 1-7.

The course work in this module, combined with class sessions should prepare you to:

Adjust correct speeds and feeds for side milling.

1. Calculate speed using RPM formula
2. Set correct speeds and feeds on mill
3. Use digital readouts to mill part to size

Module 3: Video Demonstrations

Watch the video titled: Detailing and Lubricating a Mill

Information included in this video demonstration

1. [How to clean a mill](#)
2. [How to lubricate a mill](#)

Click this link to view the video.

Module 3: Quiz

Now that you have completed the learning materials for Module 3, take the quiz to test your knowledge.

Module 3: Lab Final 3 Check in

Now that you have completed the learning materials for Module 3 and the Module 3 Quiz, check in with your instructor for more about Lab Final 3: Detailing and Lubricating a Mill.

Module 4

Module 4: Overview

Introduction to the Module: This module will introduce you to squaring a workpiece. You will have access to learning materials and activities including a video demonstration. Assessment of competencies in this module will take place in a lab final at the end of this module, and a written exam to be completed when you have completed modules 1-7.

The course work in this module, combined with class sessions should prepare you to:

Demonstrate squaring a workpiece.

1. Demonstrate milling workpiece surfaces
2. Demonstrate rotating and clamping techniques
3. Demonstrate measuring workpiece for squaring

Page: [Module 4: Tooling U]

The learning resources listed below will give you information about squaring a workpiece. It is recommended that you complete all of the Tooling U modules listed below within one week. * Learning modules contain learning material, assignments and a practice quizzes.

Click here to enter Tooling U.

1. Carbide Grade Selection
2. Ansi Insert Selection
3. Optimizing Insert Life

*Note: Modules vary in length so budget your time wisely.

Module 4: Video Demonstration

Watch the video titled: Clamp Body Drill and Tap

Information included in this video demonstration

1. [How to mill workpiece surfaces](#)
2. [How to measure for squaring](#)

Click this link to view the video.

Module 4: Lab 4 Check in

Now that you have completed the learning materials for Module 4, check in with your instructor for more about Lab 4: Dice.

Module 4: Lab Final 4 Check in

Now that you have completed the learning materials for Module 4 and Lab 4, check in with your instructor for more about Lab Final 4: Mill Clamp Body and Tap.

Module 5

Module 5: Overview

Introduction to the Module: This module will introduce you to milling a clamp body. You will have access to learning materials and activities including a video demonstration. Assessment of competencies in this module will take place in a lab final at the end of this module, and a written exam to be completed when you have completed modules 1-7.

The course work in this module, combined with class sessions should prepare you to:

Demonstrate milling a clamp body.

1. Use ball end mill to cut thumb groove
2. Determine drill sizes for tapped holes
3. Drill and tap holes

Module 5: Tooling U

The learning resources listed below will give you information about milling a clamp body. It is recommended that you complete all of the Tooling U modules listed below within one week. * Learning modules contain learning material, assignments and a practice quizzes.

Click here to enter Tooling U.

1. Milling Geometry
2. Drilling Geometry

*Note: Modules vary in length so budget your time wisely.

Module 5: Video Demonstrations

Watch the video titled: Milling a Clamp Body

Information included in this video demonstration

1. [How to use ball end mill to cut thumb grooves](#)
2. [How to calculate drill sizes for tap holes](#)
3. [How to drill and tap holes](#)

Click this link to view the video.

Determining Drill Sizes for Tapped Holes Quiz

Once you have reviewed the learning resources, check your knowledge by taking the Calculating Required Gauge Block Height Using Sine Bar Equation Quiz.

Module 5: Check in

Now that you have completed the learning materials for Module 5, check in with your instructor for more information about Lab 5: Milling a Clamp Body A.

Module 5: Check in

Now that you have completed the learning materials for Module 5 and Lab 5, check in with your instructor for more information about Lab Final 5: Milling a Clamp Body B.

Module 6

Module 6: Overview

Introduction to the Module: This module will introduce you to milling using a sine bar. You will have access to learning materials and activities including a video demonstration. Assessment of competencies in this module will take place in a lab final at the end of Module 6, to be completed when you have completed modules 1-7.

The course work in this module, combined with class sessions should prepare you to:

Demonstrate milling using a sine bar.

1. Calculate required gauge block height using sine bar equation
2. Mill workpiece using sine bar

Module 6: Video Demonstrations

Watch the video titled: Milling Using a Sine Bar

Information included in this video demonstration

1. [How to determine gauge block height using the sine bar equation](#)
2. [How to a mill a workpiece using a sine bar](#)

Click this link to view the video.

Calculating Required Gauge Block Height Using Sine Bar Equation Quiz

Once you have reviewed the learning resources, check your knowledge by taking the Calculating Required Gauge Block Height Using Sine Bar Equation Quiz.

Module 6: Lab 6 Check in

Now that you have completed the learning materials for Module 6, check in with your instructor for information about Lab 6: Brent will create practice activity

Module 6: Lab Final 2 Check in

Now that you have completed the learning materials and Lab for Module 6, check in with your instructor for information on Lab Final 6: Clamp Body Sine Bar/Radii

Module 7

Module 7: Overview

Introduction to the Module: This module will introduce you to operating a radius end mill. You will have access to learning materials and activities including a video demonstration. Assessment of competencies in this module will take place in a lab final at the end of this module, and a written exam to be completed when you have completed modules 1-7.

The course work in this module, combined with class sessions should prepare you to:

Demonstrate how to operate a radius end mill.

1. Demonstrate using a radius end mill to create a radius on a workpiece

Module 7: Video Demonstrations

Watch the video titled: Operating a Radius End Mill

Information included in this video demonstration

1. [How to use a radius end mill to create a radius on a workpiece](#)

Click this link to view the video.

Module 7: Lab Final 7 Check in

Now that you have completed the learning materials for Module 7 and Lab ___, check in with your instructor for more about Lab Final 7: Keeper.

Module 7: Written Exam 1

Now that you have completed the learning materials, activities and labs for Modules 1-7, check in with your instructor to take Written Exam 1.

Module 7: Check in

Now that you have completed the learning materials, activities, labs and written exam for Modules 1-7, check in with your instructor for exam results and information on completion of the course.

Final Labs and Rubrics

Lab Final 1

This lab final covers the output shaft. This demonstration will be scored according to a rubric.

To pass, you will need a score 100% (6 out of 6 points).

If you do not pass on the first attempt, you will have the opportunity to meet with your instructor, study and practice, and retake the lab.

Final Lab 1 Rubric

Aspect	2	1	0
Keyway Position	The keyway position is within .010 inch tolerance.	N/A.	The keyway position is NOT within .010 inch tolerance.
Keyway Depth	The keyway depth is within .005 inch tolerance.	N/A.	The keyway depth is NOT within .005 inch tolerance.
Keyway Width	The keyway width is within .002 inch tolerance.	N/A.	The keyway width is NOT within .002 inch tolerance.

Lab Final 2

This performance assessment covers mill gear teeth and broach and clamp body. This submission will be scored according to a rubric. To pass, you will need a score of at least 80% (7 out of 8 points).

If you do not pass on the first attempt, you will have the opportunity to meet with your instructor, study and practice, and retake the lab final.

Aspect	2	1	0
Gear Teeth	All teeth are properly formed.	All teeth are formed with some imperfections OR some teeth are missing.	Many or all teeth are deformed or missing.
Center Distance	The center distance is within .005 inch tolerance.	N/A.	The center distance is NOT within .005 inch tolerance.
Keyway Height	The height is within .002 inch tolerance.	N/A.	The height is NOT within .002 inch tolerance.
Keyway Weight	The width is within .001 inch tolerance.	N/A.	The width is NOT within .001 inch tolerance.

Lab Final 3

This performance assessment covers detailing and lubricating a mill. This submission will be scored according to a rubric. To pass, you will need a score of at least 80% (7 out of 8 points).

If you do not pass on the first attempt, you will have the opportunity to meet with your instructor, study and practice, and retake the lab.

Aspect	2	1	0
Metal shavings	All metal shavings are removed.	Some metal shavings are removed.	Excessive metal shavings are present.
Painted Surfaces	Painted surfaces are all wiped clean.	Painted surfaces are partly wiped clean.	Painted surfaces are NOT wiped clean.
Shiny Surfaces	Shiny surfaces are all wiped clean.	Shiny surfaces are partly wiped clean.	Shiny surfaces are NOT wiped clean.
Reservoir	Reservoir is full.	Reservoir is partially filled.	Reservoir is NOT full.
Ways	Ways are properly oiled.	Ways are oiled with excessive leftover oil.	Ways are NOT oiled.

Lab Final 4

This performance assessment covers clamp body drill and tap. This submission will be scored according to a rubric. To pass, you will need a score of at least 80% (10 out of 12 points).

If you do not pass on the first attempt, you will have the opportunity to meet with your instructor, study and practice, and retake the lab.

Aspect	2	1	0
Clamp 1: Minor Diameter of Hole	Minor diameter of hole is within .005 inch tolerance for both holes.	Minor diameter of hole is within .005 inch tolerance for only one hole.	Neither hole is within .005 inch tolerance.
Clamp 1: Hole Location	The distance between holes is within .002 inch tolerance.	N/A	The distance between holes is NOT within .002 inch tolerance.
Clamp 1: Threads	Gauge fits the thread well.	Gauge fits thread, but is loose.	Gauge is too tight to fit.
Clamp 2: Minor Diameter of Hole	Minor diameter of hole is within .005 inch tolerance for all three holes.	Minor diameter of hole is within .005 inch tolerance for only 1-2 holes.	Neither hole is within .005 inch tolerance.
Clamp 2: Hole Locations	The distance between holes is within .002 inch tolerance for both hole distances.	The distance between holes is within .002 inch tolerance for only one hole distance.	Neither hole distance is within .002 inch tolerance.
Clamp 2: Threads	Gauge fits the thread well.	Gauge fits thread, but is loose.	Gauge is too tight to fit.

Lab Final 5

This performance assessment covers clamp body sine bar. This submission will be scored according to a rubric. To pass, you will need a score of 100% (4 out of 4 points).

If you do not pass on the first attempt, you will have the opportunity to meet with your instructor, study and practice, and retake the lab final.

Aspect	2	1	0
Angle	The angle is 19° within 1° tolerance.	N/A	The angle is not within 1° tolerance of 19°.

Aspect	2	1	0
Top Length	The length is within .005 inch tolerance for both pieces.	The length is within .005 inch tolerance for only one piece.	Neither length is within .005 inch tolerance.

Lab Final 6

This lab final covers the parallel clamp keeper. This demonstration will be scored according to a rubric. To pass, you will need a score 100% (6 out of 6 points).

If you do not pass on the first attempt, you will have the opportunity to meet with your instructor, study and practice, and retake the lab.

Aspect	2	1	0
Inside Radius	The inside radius is within .002 inch tolerance.	N/A	The inside radius is NOT within .002 inch tolerance.
Mill Cutout	The mill cutout is within .002 inch tolerance.	N/A	The mill cutout is NOT within .002 inch tolerance.
Hole Position	The center of inside radius to the center of the hole is within .005 inch tolerance.	N/A	The center of inside radius to the center of the hole is NOT within .005 inch tolerance.