

## Lakeshore Technical College

31-420-385 Orthographic Projection Print - CBE

# Course Outcome Summary

### Course Information

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| --- | --- | --- |
|  | Competency | Interpret manufacturing orthographic projection prints  |
|  | Description | …prepares the learner to interpret manufacturing orthographic projection prints. |
|  | Total Credits | 1 |
|  | Total Hours | 32 |

Types of Instruction

|  |  |
| --- | --- |
| Instruction Type | Credits/Hours |
| Lab | 1/32 |

Textbooks

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| --- |
| Blueprint Reading for Machine Trades, **Author:**Schultz/Smith, 7th edition  **ISBN**: 0132172208 **Source**: Lakeshore Technical College Bookstore. **Required** |

Learner Supplies

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| --- |
| LTC Machine Tool Operations - Print Reading Study Guide. **Source:** Blackboard Course. (required) |
| LTC Math & Print Course Guidelines **Source:** Blackboard Course. (required) |
| Scientific Calculator Casio FX-991EX  . **Manufacturer:** Casio. **Source:** LTC Bookstore (optional)  |
| Six inch steel ruler. (optional)  |
| Access to a computer with internet connectivity |

### Core Abilities

|  |  |
| --- | --- |
| 1. | Apply learning |
| 2. | Apply sustainable practices |
| 3. | Communicate effectively |
| 4. | Demonstrate critical thinking |
| 5. | Demonstrate responsible and professional workplace behaviors |
| 6. | Use mathematics effectively |
| 7. | Work cooperatively |

### Program Outcomes

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| --- | --- |
| 1. | Interpret industrial/engineering drawings |
| 2. | Apply precision measuring methods to part inspection |

### Grading Information

**Skill-Building Projects**

The Skill Building Projects are considered practice and are not graded, but they are required. All Skill-Building Projects must be completed; an instructor must sign off on your assessment sheet before working on the course projects.

**Operation Check Sheets**

Operation Check Sheets must be completed and signed by an instructor before attempting course projects.

**Course Projects**

Course Projects must be 100% correct for the competency to be met.

Incorrect dimensions on the Inspection Report for course projects must be corrected or the project must be made over.

Course Projects will determine if the competency has been Met, Superiorly Met, or Not Met for this course.

**Course Tests**

All tests are open book tests; you may use your textbook and hand-written notes when taking the test. Cell phone usage or help from other students is NOT permitted. Many tests require information sheets (handouts) to be used during testing; ask an instructor for these. If you do not understand any test questions, ask an instructor for clarification.

Course tests must be 80% correct for the competency to be met.

Unlimited attempts to pass the test are allowed.

**Grading Scale**

A = Superiorly Met

B = Met

F = Not Met

### Learning Plan 1 - The Basics of Reading a Print, Definitions, Abbreviations, and line Types

**Overview/Purpose**

A drawing can describe a part, even a simple part, much more thoroughly than words. The skilled craftsman must know the shape and size before the finished product can be produced. Industrial prints of today do not resemble those of 50 years ago when copies used white lines on blue background. Prints produced since then use black lines on white background, making them much easier to read. A good quality print should show the shape and size of each part feature, plus additional information necessary to produce and assemble the part. This learning plan will focus on the basic guidelines to read a part print. Additionally, general terms and abbreviations as well as the types of lines that are used to illustrate features and other various information will also be provided through example and practice.

**Target Competencies**

|  |  |
| --- | --- |
| 1. | Interpret terminology commonly used in the machine trades. |
|   | **Assessment Strategies** |
|   | 1.1. | Skillbuilder Exercise |
|   | 1.2. | Written Assignment |
|   | **Criteria** |
|   | You will know you are successful when: |
|   | 1.1. | learner submits the assignment. |
|   | 1.2. | you can interpret commonly used terminology. |
|   | **Learning Objectives** |
|   | 1.a. | Define common abbreviations used on manufacturing drawings. |
|   | 1.b. | Define common terms used in metal manufacturing. |
| 2. | Interpret manufacturing drawings, paying close attention to common line types. |
|   | **Assessment Strategies** |
|   | 2.1. | Skillbuilder Exercise |
|   | 2.2. | Written Assignment |
|   | **Criteria** |
|   | Criteria - Performance will be satisfactory when: |
|   | 2.1. | learner submits the assignment. |
|   | 2.2. | you can identify common line types on manufacturing drawings. |
|   | **Learning Objectives** |
|   | 2.a. | Explain what each type of line represents and how it is used. |
|   | 2.b. | Identify in a drawing common line types used in manufacturing drawings. |

### Learning Activities

|  |  |
| --- | --- |
| 1. | VIEW: the learning object, [Common Abbreviations](https://www.wisc-online.com/learn/career-clusters/stem/eng12604/interpreting-engineering-drawings-common-abbr). **Source:** Blackboard Course. |
| 2. | READ/REVIEW: Dictionary of Terms pages 1 to 5 of the text. |
| 3. | COMPLETE: Terminology Quiz 1, page 6 of the text. |
| 4. | COMPLETE: Terminology Quiz 2, page 7 of the text. |
| 5. | COMPLETE: Terminology Crossword Puzzle, page 8 of the text. |
| 6. | COMPLETE: Terminology Loop-A-Word, page 9 of the text. |
| 7. | READ/REVIEW: Standard Abbreviations, pages 10 to 11 of the text. |
| 8. | COMPLETE: Abbreviation Quiz 1, page 12 of the text. |
| 11. | COMPLETE: Abbreviation Quiz 2, page 13 of the text. |
| 12. | COMPLETE: abbreviation Loop-A-Word, page 14 of the text. |
| 13. | VIEW: the learning object, [Basic Elements of Dimensions Used in Engineering Drawings](https://www.wisc-online.com/learn/technical/engineering/eng16104/basic-elements-of-dimensions-used-in-engineer). **Source:** Blackboard Course. |
| 14. | VIEW: the learning object, [Basic types of lines used on engineering drawings](https://www.wisc-online.com/learn/technical/engineering/eng16004/basic-types-of-lines-used-in-engineering-draw). **Source:** Blackboard Course. |
| 15. | VIEW: the learning object, [Alphabet of Lines.](https://www.wisc-online.com/learn/technical/machine-tool/mtl17903/print-reading-an-alphabet-of-lines-in-print-r) **Source:** Blackboard Course. |
| 16. | READ: Alphabet of Lines, page 15 and 16 of the text. |
| 17. | COMPLETE: Alphabet of Lines Quiz 1, page 17 of the text. |
| 18. | COMPLETE: Alphabet of Lines Quiz 2, page 18 of the text. |
| 19. | COMPLETE: Alphabet of Lines Quiz 3, page 19 of the text. |
| 20. | VIEW: [Unit 1 lecture video](https://youtu.be/9KZlMfYTOT0) |

### Assessment Activities

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| --- | --- |
| 1. | COMPLETE: ASSIGNMENT [Alphabet of Lines Quiz 4, page 20](https://gotoltc.blackboard.com/bbcswebdav/pid-1142875-dt-content-rid-1719230_1/xid-1719230_1).  [Assignment review video](https://youtu.be/XYYT2AVOZ-Y) |

### Learning Plan 2 - Dimensions and Title Block Information

**Overview/Purpose**

Dimensions provide the machine operator with information about size of the features that are represented on the part drawing.  These dimensions can be illustrated in a variety of methods.  Tolerances provide the operator with a guide to how close to exact size does the feature have to be produced.  Tolerances like dimensions can be provided in fractional and decimal form. Typically, fractional tolerances are considered to be more open, meaning the operator should have less trouble making the part.  Decimal tolerances many times will require more effort to produce quality parts because the part will require less error, meaning the part must be made closer to the exact size.  Surface finishes requirements are also dimensioned on part drawings.  Finishes typically use a series of symbols and numbers to explain the surface requirement on the feature.  This learning plan will focus on dimensions, tolerances, and surface finishes.  The learner will see through example and practice how dimensions tolerances and finishes are interpreted on detailed part drawings.

**Target Competencies**

|  |  |
| --- | --- |
| 1. | Interpret manufacturing drawings, paying close attention to dimensional systems, title block information and drawing notes. |
|   | **Assessment Strategies** |
|   | 1.1. | Skillbuilder Exercise |
|   | 1.2. | Written Assignment |
|   | 1.3. | Written Test |
|   | **Criteria** |
|   | Criteria - Performance will be satisfactory when: |
|   | 1.1. | learner submits the assignment. |
|   | 1.2. | learner applies the information in the title block to the part print drawing. |
|   | 1.3. | learner completes written test. |
|   | **Learning Objectives** |
|   | 1.a. | Recognize different dimension arrangements used on working drawings. |
|   | 1.b. | Explain the different types of title block information. |
|   | 1.c. | Explain what a tolerance is and define its importance. |
|   | 1.d. | Explain how tolerances can be displayed on drawings. |
|   | 1.e. | Recognize factors that affect tolerances. |

### Learning Activities

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| --- | --- |
|  |  |
| 1. | VIEW: the learning object, [Title Block Tolerances](https://www.wisc-online.com/learn/technical/engineering/eng19604/title-block-tolerances). **Source:** Blackboard Course. |
| 2. | VIEW: the learning object, [Title and revision blocks](https://www.wisc-online.com/learn/technical/engineering/eng14204/interpreting-engineering-drawings-title-and-r). **Source:** Blackboard Course. |
| 3. | READ: pages 21 to 45 of the text, and complete all included quizzes and exercises |
| 4. | COMPLETE: Drawing size quiz, page 28 of your text. |
| 5.6. | COMPLETE: Drawing Notes Quiz, page 30 of your text.VIEW: [Unit 2 lecture video](https://youtu.be/f7qw_ZuQNGs) |

### Assessment Activities

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| --- | --- |
| 1. | COMPLETE: Assignment - [MMC Allowance Quiz](https://gotoltc.blackboard.com/bbcswebdav/pid-1142877-dt-content-rid-1723742_1/xid-1723742_1)located on pages 43 of your text. |
| 2. | COMPLETE: Assignment - Spacer located on pages [44 and 45](https://gotoltc.blackboard.com/bbcswebdav/pid-1142877-dt-content-rid-5458100_1/xid-5458100_1) of your text. |
| 3. | VIEW: [Assignment review video](https://youtu.be/t6yjT67dFmk) |
| 4. | COMPLETE: Print Test for Units 1 and 2. |

### Learning Plan 3 - Sketching and Projection of Views

**Overview/Purpose**

The ability to produce a free hand sketch of a part or parts is a very valuable asset to have.  As a machinist or millwright you may be called upon to produce a rough sketch of a prototype part to be machined.  Remember like a print, sketches communicate to the machinist, welder, millwright necessary information to produce a part or convey an idea to a superior.  In this learning plan the learner will produce a variety of freehand isometric and orthographic sketches.

**Target Course Competencies**

|  |  |
| --- | --- |
| 1. | Apply sketching techniques to the development of both isometric and orthographic drawings. |
|   | **Assessment Strategies** |
|   | 1.1. | Skillbuilder Exercise |
|   | 1.2. | Written Assignment |
|  | **Criteria** |
|   | Criteria - Performance will be satisfactory when: |
|   | 1.1. | learner sketches an orthographic drawing from an isometric pictorial. |
|   | 1.2. | learner sketches an isometric pictorial from a orthographic drawing. |
|   | 1.3. | learner completes written assignment. |
|   | **Learning Objectives** |
|   | 1.a. | Explain the relationships among surfaces, lines and points. |
|   | 1.b. | Explain the importance of the relative positions of views on an industrial print. |
|   | 1.c. | Recognize the viewings angles for the front, top and side views. |
|   | 1.d. | Recognize differences between isometric perspective and oblique perspective drawings. |
|   | 1.e. | List the factors that determine which view is selected as the front view. |
|   | 1.f. | Create orthographic flat view drawings from isometric perspective drawings. |
|   | 1.g. | Create  isometric perspective drawings from orthographic flat view drawings. |

### Learning Activities

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| --- | --- |
| 1. | VIEW: the learning object, [Orthographic Projection](https://www.wisc-online.com/learn/career-clusters/stem/eng19204/orthographic-projection-1). **Source:** Blackboard Course. |
| 2. | VIEW: the learning object, [Orthographic Projection Visualization  #2](https://www.wisc-online.com/learn/technical/engineering/eng19404/brain-exercise-visualization-2). **Source:** Blackboard Course. |
| 3. | VIEW: the learning object, [Print Reading Angled Mount](https://www.wisc-online.com/learn/technical/machine-tool/mtl17502/print-reading-angled-mount). **Source:** Blackboard Course. |
| 4. | VIEW: the learning object, [Print Reading Mounting Wedge](https://www.wisc-online.com/learn/technical/machine-tool/mtl17202/print-reading-mounting-wedge). **Source:** Blackboard Course. |
| 5. | VIEW: the learning object, [Print Reading Slotted Bloc](https://www.wisc-online.com/learn/technical/machine-tool/mtl3302/print-reading-slotted-block)k. **Source:** Blackboard Course. |
| 6. | VIEW: the learning object, [Print Reading Three Step Block](https://www.wisc-online.com/learn/technical/machine-tool/mtl17102/print-reading-three-step-block).**Source:** Blackboard Course. |
| 7. | VIEW: the learning object,[Pictorial Drawings](https://www.wisc-online.com/learn/career-clusters/stem/eng20004/pictorial-drawings). **Source:** Blackboard Course. |
| 8.9. | READ: pages 49 to 72 of the text, and complete all included quizzes and exercises.VIEW: [Unit 3 Lecture video](https://youtu.be/-3Ajs1daur4) |

### Assessment Activities

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| --- | --- |
| 1. | COMPLETE:  Assignment- [Isometric Sketch #2 located on page 65](https://gotoltc.blackboard.com/bbcswebdav/pid-1142879-dt-content-rid-1719231_1/xid-1719231_1) and[Orthographic Sketch #3 located on page 69](https://gotoltc.blackboard.com/bbcswebdav/pid-1142879-dt-content-rid-1719232_1/xid-1719232_1) of the text. |

### Learning Plan 4 - Multi-view Drawings

**Overview/Purpose**

A sufficient amount of dimensions to produce the object will appear on every detail drawing.  Each dimension will appear only once, however, to avoid confusion and possible error in interpretation.  Sometimes the drafter may place the dimension a different view than where you think they should appear, so by becoming proficient at reading multi-view drawings you will know which of the other views could contain those dimensions.

**Target Course Competencies**

|  |  |
| --- | --- |
| 1. | Interpret multi-view drawings for the purpose of determining missing dimensions, using standard and specific tolerances. |
|  | **Assessment Strategies** |
|   | 1.1. | Skillbuilder Exercise |
|   | 1.2. | Written Assignment |
|   | 1.3. | Written Test |
|   | **Criteria** |
|   | Performance will meet expectations when: |
|   | 1.1. | learner will interpret multi-view drawings for specific dimensions. |
|   | 1.2. | learner submits the assignment. |
|   | 1.3. | learner completes written test. |
|  | **Learning Objectives** |
|   | 1.a. | Recognize and apply concepts of chain dimensioning. |
|   | 1.b. | Recognize and apply concepts of absolute dimensioning. |
|   | 1.c. | Translate feature dimensions from view to view. |

### Learning Activities

|  |  |
| --- | --- |
| 1.2. | READ: pages 75 to 97 of the text, and complete all included quizzes and exercises.VIEW: [Unit 4 Lecture Video](https://youtu.be/ov8oKQUZnes) |

### Assessment Activities

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| --- | --- |
| 1.2. | COMPLETE:  the assignment  - [Dimension Calculations 5](https://gotoltc.blackboard.com/bbcswebdav/pid-1142881-dt-content-rid-1723743_1/xid-1723743_1) located on pages 93 of the text. |
| VIEW: [Assignment Review Video](https://youtu.be/B6ITsJUlM1k) |
| 3. | COMPLETE: Print Test for Units 3 and 4. |

### Learning Plan 5 - Inclined Planes, Foreshortened Views, Angular Dimensions

**Overview/Purpose**

Inclined planes are at right angles to two of the six principal orthographic views, thus appearing as an edge on those two views.  The remaining four views, however, will show the inclined planes foreshortened.   Dimensioning of inclined planes can be accomplished by using a coordinate method or an angular method.  The angular method uses one linear dimension and one angular dimension.  This learning plan will focus on the representation of and the dimensioning of inclined surfaces.

**Target Course Competencies**

|  |  |
| --- | --- |
| 1. | Interpret manufacturing drawings that use foreshortened views, and determine missing angular dimensions. |
|   | **Assessment Strategies** |
|   | 1.1. | Skillbuilder Exercise |
|   | 1.2. | Written Assignment |
|   | **Criteria** |
|   | Performance will be satisfactory when: |
|   | 1.1. | learner will interpret multi-view drawings with foreshortened views and inclined planes. |
|   | 1.2. | learner submits the assignment. |
|   | **Learning Objectives** |
|   | 1.a. | Determine included angle dimensions. |
|   | 1.b. | Determine angle of centerline dimensions. |
|   | 1.c. | Determine lengths of slots and grooves. |

### Learning Activities

|  |  |
| --- | --- |
| 1.2. | READ: pages 98 to 123 of the text, and complete all included quizzes and exercises.VIEW: [Unit 5 Lecture Video](https://youtu.be/VGQYwNKP1JQ) |

### Assessment Activities

|  |  |
| --- | --- |
| 1.2. | COMPLETE:  the assignment - [Tool Slide located on pages 124 and 125](https://gotoltc.blackboard.com/bbcswebdav/pid-1142883-dt-content-rid-1719233_1/xid-1719233_1) of the text.VIEW: [Assignment Review](https://youtu.be/QUVH4TPy-Ps) |

### Learning Plan 6 - Dimensioning Features

**Overview/Purpose**

How is the depth of a hole dimensioned?  Is it a through or blind hole?  How are chamfers dimensioned?  Or Keyways?  No matter what the feature is the designer has to provide the operator with enough detail that is readily available to manufacture the part.  In this learning plan you will discover many methods of dimensioning common features found on most engineering drawings including surface finishes.

**Target Course Competencies**

|  |  |
| --- | --- |
| 1. | Interpret manufacturing drawings paying close attention to reference dimensions, keyseats, keyways, counterbores, countersinks, and surface finish characteristics. |
|   | **Assessment Strategies** |
|   | 1.1. | Skillbuilder Exercise |
|   | 1.2. | Written Assignment |
|   | 1.3. | Written Test |
|   | **Criteria** |
|   | Performance will be satisfactory when: |
|   | 1.1. | learners will interpret surface finish information. |
|   | 1.2. | learner applies the information  on  a part print drawing with respect to holes, chamfers and keyways. |
|   | 1.3. | learner submits the assignment. |
|   | 1.4. | learner completes written test. |
|   | **Learning Objectives** |
|   | 1.a. | Determine reference dimensions. |
|   | 1.b. | Determine working dimensions of keyseats and keyways. |
|   | 1.c. | Recognize symbols that are used to describe surface finish. |
|   | 1.d. | Interpret surface finish symbols used on a drawing. |
|   | 1.e. | Describe methods of checking surface finish. |

### Learning Activities

|  |  |
| --- | --- |
| 1. | VIEW: the learning object, [Surface Texture Symbols](https://www.wisc-online.com/learn/career-clusters/stem/eng20104/surface-texture-symbols). **Source:** Blackboard Course. |
| 2. | VIEW: the learning object, [Surface Finishes](https://www.wisc-online.com/learn/career-clusters/manufacturing/msr4003/surface-finish). **Source:** Blackboard Course. |
| 3. | VIEW: the learning object, [Surface Finish Quiz](https://www.wisc-online.com/learn/technical/measurement/msr2402/surface-finish-quiz). **Source:** Blackboard Course. |
| 4.5. | READ: pages 129 to 151 of the text, and complete all included quizzes and exercises.VIEW: [Unit 6 Lecture video](https://youtu.be/WmmzfghQrGY) |

### Assessment Activities

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| --- | --- |
| 1.2.3. | COMPLETE:  the assignment  - [SPL FLG CPLG Bracket located on pages 152 and 153](https://gotoltc.blackboard.com/bbcswebdav/pid-1142885-dt-content-rid-1719234_1/xid-1719234_1) of the text. |
| VIEW: [Assignment review video](https://youtu.be/UUAyBXXzVFo) |
| COMPLETE: Unit 5 and 6 Test |

### Learning Plan-7: Dimensioning Irregular Features

**Overview/Purpose**

Not all parts manufactured today are made from plate steel or aluminum.  Many parts are machined from castings.  A castings is a part that is produced in a foundry that is produced to nearly the completed shape of the final part.  Castings typically have unique features that are not found on most parts manufactured from steel or aluminum plate, features like raised bosses's and raised pads.  Other features like elongated slots while they are not unique to castings, they present problems to the operator when determining the actual length of the slotted hole.  In this learning plan you will see how features such as tapers and necks are dimensioned and how you can determine missing dimensions by using simple mathematical principles.

**Target Course Competencies**

|  |  |
| --- | --- |
| 1. | Interpret manufacturing drawings paying close attention to these details:  bosses, pads, castings dimensions, tapers, limit dimensions, steel processing, and steel markings. |
|   | **Assessment Strategies** |
|   | 1.1. | Skillbuilder Exercise |
|   | 1.2. | Written Assignment |
|  | **Criteria** |
|   | Performance will be satisfactory when: |
|   | 1.1. | learner will interpret drawings for bosses, pads, slotted holes, necks and casting requirements. |
|   | 1.2. | learner submits the assignment. |
|  | **Learning Objectives** |
|   | 1.a. | Determine working dimensions of bosses on castings and machined parts. |
|   | 1.b. | Determine working dimensions of pads on castings and machined parts. |
|   | 1.c. | Determine taper per foot and taper per inch of tapered parts. |
|   | 1.d. | Determine large and small diameters of a tapered part. |
|   | 1.e. | Use charts to determine steel composition characteristics. |
|   | 1.f. | Determine machining information from enlarged views. |

### Learning Activities

|  |  |
| --- | --- |
| 1. | PARTICIPATE: in a group discussion on dimensioning irregular features. |
| 2.3. | READ: pages 155 to 175 of the text, and complete all included quizzes and exercises.VIEW: [Unit 7 Lecture video](https://youtu.be/YiSS-tgNZAQ) |

### Assessment Activities

|  |  |
| --- | --- |
| 1. | COMPLETE: the assignment  - [Taper Calculations, page 161](https://gotoltc.blackboard.com/bbcswebdav/pid-1142887-dt-content-rid-1723744_1/xid-1723744_1), problems A, D, and F |
| 2. | COMPLETE: the assignment - [Center Punch, pages 174 and 175](https://gotoltc.blackboard.com/bbcswebdav/pid-1142887-dt-content-rid-1723744_1/xid-1723744_1), problems 1-10. |
| 3.4. | COMPLETE: the assignment - [Groove Pin, pages 176 and 177](https://gotoltc.blackboard.com/bbcswebdav/pid-1142887-dt-content-rid-1723744_1/xid-1723744_1), problems 1-8 |
| VIEW: Assignment review video |
| 5.6. | COMPLETE: Print Test for Unit 7.COMPLETE: Superiorly Met competency, Review assignment, page 94 (with calculation work shown)  |