

RAJA KRISHNAMOORTHY
8TH DISTRICT, ILLINOIS

515 CANNON HOUSE OFFICE BUILDING
WASHINGTON, DC 20515

TELEPHONE: (202) 225-3711
FAX: (202) 225-7830

1701 EAST WOODFIELD ROAD, SUITE 704
SCHAUMBURG, IL 60173

TELEPHONE: (847) 413-1959
FAX: (847) 413-1965

www.krishnamoorthi.house.gov

Congress of the United States
House of Representatives
Washington, DC 20515

COMMITTEE ON
OVERSIGHT & GOVERNMENT REFORM

SUBCOMMITTEES:
HEALTH CARE, BENEFITS,
AND ADMINISTRATIVE RULES
RANKING MEMBER

INFORMATION TECHNOLOGY

COMMITTEE ON
EDUCATION AND THE WORKFORCE

SUBCOMMITTEES
HIGHER EDUCATION AND
WORKFORCE DEVELOPMENT
WORKFORCE PROTECTIONS

November 13, 2018

To Whom It May Concern:

Thank you for hosting the CTE Excellence in Action Awards, and for incentivizing and honoring innovative secondary and post-secondary CTE programs that provide meaningful work-based learning opportunities for students and job-seekers across the country.

I want to express my strong support for several School District U-46 CTE Programs at South Elgin, Streamwood, Bartlett, Elgin, and South Elgin High Schools, many of which are located in the 8th Congressional District of Illinois. Specifically, I would like to point out the Precision Manufacturing Program (accredited by the National Institute of Metalworking Skills), the Automotive Technology Program (accredited by the National Automotive Education Foundation), and the Welding Program (accredited by the American Welding Society).

Just a few months ago I had the pleasure of touring these programs in Elgin and South Elgin High Schools, where I explored high-tech facilities, met with excellent teachers and administrators, and heard firsthand from students aspiring to be precision manufacturers, automotive technicians, and welders. Aside from putting CTE dollars to appropriate use by creating state-of-the-art classrooms, these programs do right by our students by equipping them with industry-certified credentials and a direct path towards a good-paying job in their local community.

As the co-lead of the Strengthening Career and Technical Education for the 21st Century Act, or Perkins V, I understand the tremendous value of career and technical education in America and appreciate your efforts to help millions of students obtain the academic and technical skills to excel in the 21st century. When reviewing applications for the Excellence in Action Awards, I ask that you please consider School District U-46's CTE Programs in Illinois.

Sincerely,



Raja Krishnamoorthi
Member of Congress



November 8, 2018

Advance CTE
8484 Georgia Avenue Suite 620
Silver Springs, Maryland 20910

Attention: Excellence in Action Award Committee

The Alignment Collaborative for Education joins Congressman Raja Krishnamoorthi in nominating School District U-46 for the Advance CTE's Excellence in Action Award. As the second largest school district in Illinois, U-46 is committed to having all students' academic and career ready.

Our collaboration with U-46 brings 120 business and community partners to the table to assist in the implementation of career clusters. Central to that work is the progression from secondary to post-secondary enrollment requiring that strong partnerships are built with both two-year and university institutions. Our business and community partners are working directly with U-46 to expand and build new work-based learning opportunities for students contributing to their academic and career success.

This nomination is supported by Alignment's Governing Board as evidenced by the attached recommendation. These community leaders represent key industries within our region as well as community organizations and municipalities. If there is any additional information that we can provide in support of this nomination, please contact me at 847-744-0478 or by email at colemanace@align4edu.org.

Thank you for the opportunity to recommend School District U-46 and to endorse its efforts to lead the way in business and community engagement for greater student opportunities and success.

Sincerely,

A handwritten signature in blue ink, appearing to read "Nancy H. Coleman", is written over a large, light blue scribble.

Nancy H. Coleman
Executive Director

The National Institute for Metalworking Skills, Inc.



**Duties and Standards For
Machining Skills-Level I**

NIMS/ANSI 101-2001



Developed By:



Copyright July 1997-Revised September 2001

Distributed by: The National Institute for Metalworking Skills, Inc
3251 Old Lee Highway
Fairfax, VA 22030
1-703-352-4971 Fax 1-703-352-4991
www.nims-skills.org

Level 1 Machining Skills

Duties and Standards
for
Level I
Machining Skills

Level I Machining Skills

Table of Contents

Overview	9
Background	10
Description of Typical Level I Machining Responsibilities	10
Bench Operations	11
Metal Cutting Operations	11
Inspection and Quality Assurance Responsibilities	11
Other Competency Areas	11
Education and Training	12
Related Occupations in the United States	12
Program (Curriculum) Standards in the United States	13
International Benchmarks	14
Duty Framework for Level I Machining Skills-Figure 1	15
A Skills and Credentialing Framework-Figure 2	15
Level I Machining Skills	
Duty Area: 1. Job Planning and Management	17
Duty: 1.1 Job Process Planning	
Duty Area: 2. Job Execution	19
Duty: 2.1 Manual Operations: Benchwork	21
Duty: 2.2 Manual Operations: Layout	23
Duty: 2.3 Turning Operations: Between Centers Turning	25
Duty: 2.4 Turning Operations: Chucking	27
Duty: 2.5 Milling: Square Up a Block	29
Duty: 2.6 Vertical Milling	31
Duty: 2.7a Surface Grinding	33
Duty: 2.7b Surface Grinding	35
Duty: 2.8 Drill Press	37
Duty: 2.9 CNC Programming	37
Duty Area: 3. Quality Control and Inspection	39
Duty: 3.1 Part Inspection	41
Duty: 3.2 Process Control	41
Duty Area: 4. Process Adjustment and Improvement	43
Duty: 4.1 Process Adjustment-Single Part Production	45
Duty: 4.2 Participation in Process Improvement	45
Duty Area: 5. General Maintenance	47
Duty: 5.1 General Housekeeping and Maintenance	49
Duty: 5.2 Preventive Maintenance, Machine Tools	51
Duty: 5.3 Tooling Maintenance	51

Level I Machining Skills

Duty Area: 6.	Industrial Safety and Environmental Protection	
Duty: 6.1	Machine Operations and Material Handling.....	53
Duty: 6.2	Hazardous Materials Handling and Storage	55
Duty Area: 7.	Career Management and Employment Relations	
Duty: 7.1	Career Planning.....	57
Duty: 7.2	Job Application and Interviewing.....	57
Duty: 7.3	Teamwork and Interpersonal Relations	57
Duty: 7.4	Organizational Structures and Work Relations	58
Duty: 7.5	Employment Relations.....	58

Knowledge, Skills, Abilities, and Other Characteristics

KSAO Area: 1.	Written and Oral Communication	
KSAO: 1.1	Reading	60
KSAO: 1.2	Writing	62
KSAO: 1.3	Speaking.....	64
KSAO: 1.4	Listening	66
KSAO Area: 2.	Mathematics	
KSAO: 2.1	Arithmetic	68
KSAO: 2.2	Applications of Geometry.....	70
KSAO: 2.3	Applications in Algebra.....	72
KSAO: 2.4	Applications in Trigonometry.....	73
KSAO: 2.5	Applications of Statistics	74
KSAO Area: 3.	Decision Making and Problem Solving	
KSAO: 3.1	Applying Decision Rules.....	75
KSAO: 3.2	Basic Problem Solving.....	77
KSAO Area: 4.	Social Skills and Personal Qualities	
KSAO: 4.1	Social Skills	78
KSAO: 4.2	Personal Qualities.....	80
KSAO Area: 5.	Engineering Drawings and Sketches	
KSAO: 5.1	Standard Orthographic Prints.....	81
KSAO: 5.2	GD&T Orthographic Prints	82
KSAO: 5.3	GD&T Datums, Symbolology and Tolerances	83

Level I Machining Skills

KSAO Area:	6.	Measurement	84
	KSAO: 6.1	Basic Measuring Instruments.....	85
	KSAO: 6.2	Precision Measuring Instruments.....	86
	KSAO: 6.3	Surface Plate Instruments	87
	KSAO 6.4	Metric Conversion	87
KSAO Area:	7.	Metalworking Theory	88
	KSAO: 7.1	Cutting Theory	89
	KSAO: 7.2	Tooling	90
	KSAO: 7.3	Material Properties	91
	KSAO: 7.4	Machine Tools	92
	KSAO: 7.5	Cutting Fluids and Coolants	92
KSAO Area	8.	Introduction to CNC	93
	KSAO 8.1	Word Address Program Codes.....	93

List of Figures

Figure 1	Occupational Framework for Metalworking in the United States	15
Figure 2	Framework for Level I Machining Skills	16

Overview

OVERVIEW

1. Background

In late fall 1992, the U.S. Departments of Education and Labor launched an initiative to fund industry organizations and consortia to develop national occupational skill standards for their industries. Skill standards refer to the major duties, knowledge, and skills that workers must proficiency to meet performance requirements and expectations in the modern workplace. The national basis of these standards refers to the process followed in their development, namely that they be reviewed and reflect employer and employee opinions in the industry as that industry is distributed nationwide. The skill standards, once established, are intended to guide workforce development programs in the public and private sectors in building a world-class workforce in the United States.

The National Tooling and Machining Association (NTMA) was selected to work with other leading organizations in the metalworking industry to establish national skill standards for metalworking occupations. This effort is developing standards with input from workers, employers, trainers, and educators nationwide. The standards are being benchmarked to those in Germany, Japan, and other leading metalworking countries. The standards are proposed for broad application in all public and private workforce development programs that prepare youth and adults for employment in the metalworking industry. They also are intended for application in upgrading programs, retraining programs, and apprenticeships for workers already employed by metalworking companies.

NTMA has been joined by seven other trade associations and three organized labor institutions in this skill standards development effort.¹ These associations work cooperatively through the National Institute for Metalworking Skills, Inc. to guide the establishment of national standards for the industry. Major responsibilities of the Institute include:

- developing recognized occupations organized into career paths within the industry;
- writing and verifying skill standards for each recognized career path;
- providing for the assessment and credentialing of workers; and assessment, and
- certifying of training programs that train to the industry's skill standards.

¹The Council of Great Lakes Governors also is participating. The Council and six of its member states pledged to pilot the metalworking skill standards in publicly administer training programs. Representatives from the Council and involved states attend meetings of the Metalworking Industry Skill Standards Board and serve on an overall project steering committee.

Level I Machining Skills

The National Institute for Metalworking Skills, Inc., recognizes that career paths can develop from four major occupational groups in the metalworking industry (see Figure 1). These are machining, tooling, metalforming, and industrial maintenance occupations. Within each occupational group or cluster, multiple job titles can exist and such titles as may be invoked is the prerogative of individual metalworking companies.

The Institute focuses on defining skills and recommends that each occupational cluster reflect increasing levels of competency or skills. Three skill levels are suggested for each major cluster.

2. Description of Typical Level I Machining Responsibilities

An individual with Level I Machining Skills is a *skilled* machine operator or technician who has demonstrated competence in three major areas of responsibility:

1. basic bench operations
2. basic metal cutting operations
3. basic inspection and quality assurance functions.

This individual can perform these responsibilities in both single and multiple part production. No direct supervision or training responsibilities of other operators or other production workers is assumed at level I.

Level I Machining Responsibilities typically include the ability to: (**Note: These are not the standards**)

Bench Operations:

- Select and use hand tools.
- Perform basic, routine layout.
- Read and comprehend information on orthographic prints and job process sheets for routine manufacturing operations.
- Deburr.
- Perform hand fitting and minor assembly.
- Perform bench cutting tasks such as sawing, reaming, and tapping.
- Perform basic, routine preventive maintenance.
- Perform basic housekeeping responsibilities.

Level I Machining Skills

Metal cutting operations:

- Identify basic metallic and non-metallic materials.
- Identify and use most accessories and tooling for machining operations.
- Choose an appropriate speed and feed for a given operation.
- Perform basic process planning, setup, and operation of common classes of machine tools such as turning, milling, drilling, or surface grinding machines.
- Select and use coolants appropriately.
- Make suggestions for improving basic machining operations within a structured improvement process.
- Be competent in all safety procedures for all machining operations and material handling and disposal within their responsibility.

Inspection and quality assurance responsibilities:

- Use basic precision measurement tools.
- Follow an inspection process plan.
- Perform basic quality assurance responsibilities for both single and multiple part production including statistical process control.

Other competency areas:

- Follow standardized work procedures in a limited range of standardized work contexts under direct supervision.
- Be competent in all basic aspects of seeking and maintaining employment in the metalworking industry.

3. Education and Training

Most trainees can acquire the core Level I Machining Skills in six months to one year of education and training, depending on prior manufacturing experience, basic academic skills, mechanical aptitudes, and the availability of laboratory-based training. This training could be given in a high school or community college vocational/technical education program, apprenticeship program, formal company training program, or structured on-the-job training. Existing workers may be able to demonstrate their competence against the standards in shorter time periods and access necessary education and training through community colleges, private programs training centers, retraining or upgrading.

4. Related Occupations in the United States

Related Standard Occupational Classification (SOC) and Dictionary of Occupational Titles (DOT) occupations that can include Level I Machining Skills are:

- Lathe and turning machine operators (SOC 7512)
- Milling and planing machine operators (SOC 7313, 7513)
- Grinding, abrading, buffing, and polishing machine operators (SOC 7322, 7324, 7522)
- Miscellaneous metalworking machine operators (SOC 7329)
- Grinding machine operators (DOT 603.482-034)
- Lathe operator, production (DOT 604.685-026)
- Milling machine operator, production (DOT 605.685-030)
- Drill press operator (DOT 606.682-014)
- Vertical band-saw/cut-off-saw operators (DOT 607.682-010)

5. Program (Curriculum) Standards in the United States

Major national, state, and local curriculum standards used in the United States that have been consulted in developing standards for Level I Machining Skills include:

- Ohio's Competency Analysis Profile-Machine Trades
- California Curriculum Standards-Manufacturing Technology, Machine Tools
- Similar State Vocational Education Competencies in Great Lakes States
- Chicago Machine Trades Advisory Group-Basic and Intermediate Levels.
- National Tooling and Machining Association, Competency Profile Certificate and Metalworking Training System, Level 1.
- Tooling and Manufacturing Association-Apprenticeship Programs, first year of related theory courses.
- International Association of Machinists and Aerospace Workers, Automotive and Metal Trades Apprenticeship Training Program, first year.
- ASTD Workplace Basics.
- SCANS Skills.

6. International Benchmarks

Major international occupational standards that have been used in benchmarking the Level I Machining Skills include:

- German Apprenticeship System, Metalcutting Mechanic, First Year Training Schedule.
- CEDEFOP (European Community), Setter/Operator of Production Machines, Metal Sector
- Japan National Association of High School Principals, certificate exams for mechanical drawing, industrial mathematics, and machinery-mechanical work.
- Japanese Ministry of Labor Trade Tests, Basic Training and Grade 1 Upgrading Training, machining, machine maintenance, machine part inspection.
- Australian Standard Framework, Metalcutting Occupations, Levels 1 and 2.
- Canadian JOBSCAN Profiles, Metalworking Machine Setters and Operators, Level 1.

7. Duty Framework for Level I Machining Skills:

Duties represent the most important responsibilities that workers are expected to perform. Each duty area may consist of a single or multiple duties. Each duty requires demonstrated competence for its execution. The duty competencies are defined as performance standards and include accuracy requirements that must be achieved within specified times. Each duty or standard also details the knowledge, academic skills, and other performance related characteristics that must be demonstrated to satisfy the standard. These duty standards are to be assessed by written and oral examinations, and performance examinations. These skill standards form the basis for awarding credentials of achievement.

The duty framework for Level I Machining is described below in Figure 2. The left-hand column lists the 7 duty areas and 25 duty titles of the level I skills. The right-hand column identifies the knowledge, academic skills, and other characteristics that undergird the duties and must be mastered to meet the performance-based duty standards. Performance on each of the job execution duties can be assessed independently. Workers and trainees can demonstrate their ability to achieve or exceed the standards for job execution one duty at a time and receive credentials accordingly. Employers may prefer to describe jobs or positions by the mix of duty skills being sought. This framework is intended to encourage workforce development programs to modularize their approaches to curriculum development and program delivery. Workers and employers can use the duty or skill standards over Levels I, II, and III to create career paths and to define learning and training opportunities and needs.

Figure 1. Framework for Level I Machining Skills

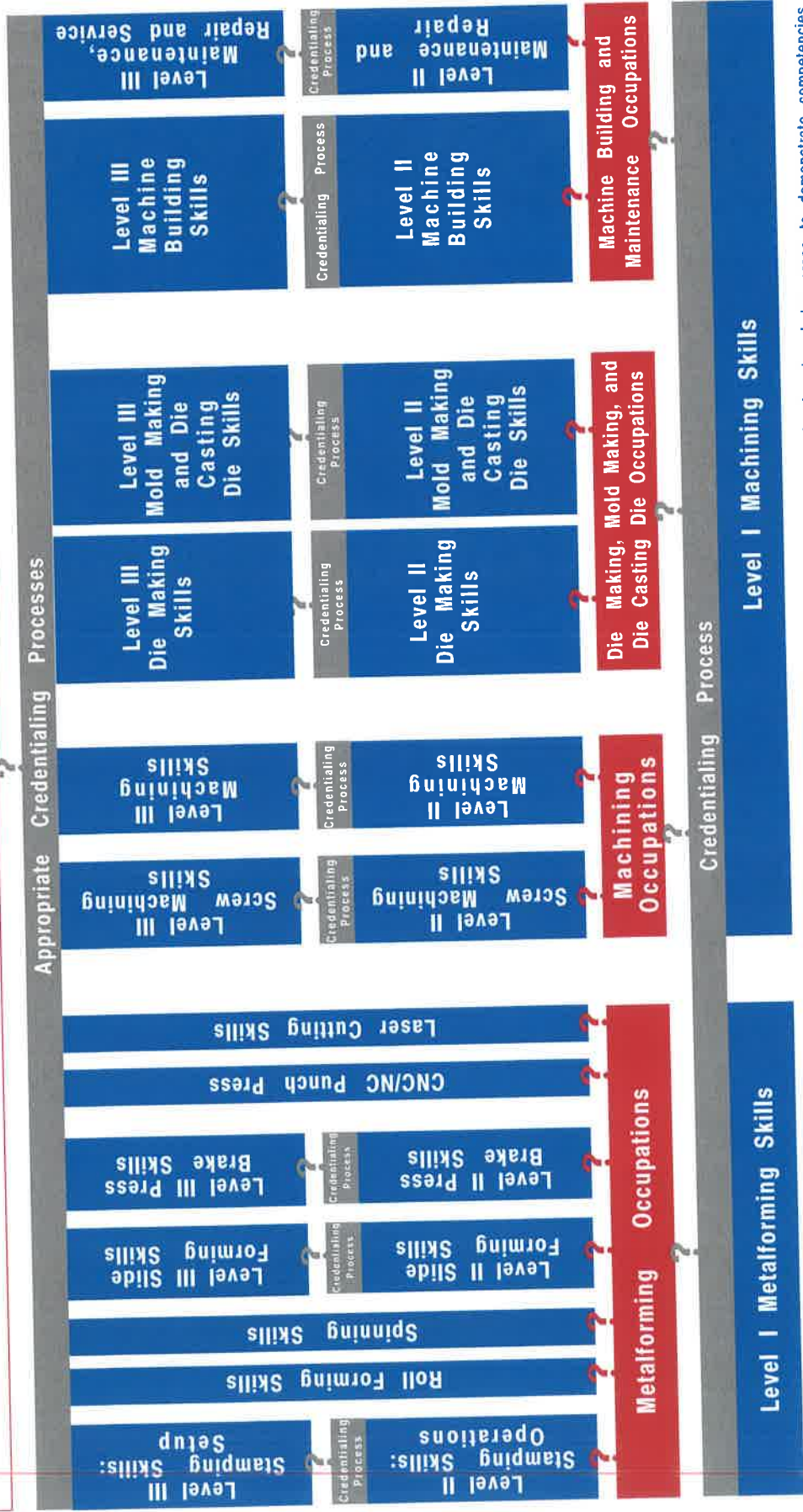
This figure represents the two principal sets of expectations that comprise Level I Machining Skills. The left-hand column is a listing of the duties that are expected to constitute Level I jobs. The right-hand column is a listing of the abilities, skills, knowledge, or other characteristics that are needed to perform the duties.

Occupational Duties	Knowledge, Skills, Abilities, and Other Characteristics
<p>1. Job Planning and Management 1.1 Job Process Planning</p>	<p>1. Written and Oral Communications 1.1 Reading 1.2 Writing 1.3 Speaking 1.4 Listening</p>
<p>2. Job Execution 2.1 Manual Operations Benchwork 2.2 Manual Operations Layout 2.3 Turning Operations-Between Centers Turning 2.4 Turning Operations-Chucking <u>2.5 Milling: Square Up a Block</u> <u>2.6 Vertical Milling</u> 2.7a Grinding Wheel Safety 2.7b Surface Grinding 2.8 Drill Press Operations <u>2.9 CNC Programming</u></p>	<p>2. Mathematics 2.1 Arithmetic 2.2 Applied Geometry 2.3 Applied Algebra 2.4 Applied Trigonometry 2.5 Applied Statistics</p>
<p>3. Quality Control and Inspection 3.1 Part Inspection 3.2 Process Control</p>	<p>3. Decision Making and Problem Solving 3.1 Applying Decision Rules 3.2 Basic Problem Solving</p>
<p>4. Process Adjustment and Control 4.1 Process Adjustment, Single Part Production 4.2 Participation in Process Improvement</p>	<p>4. Group Skills and Personal Qualities 4.1 Group Participation and Teamwork 4.2 Personal Qualities</p>
<p>5. General Maintenance 5.1 General Housekeeping and Maintenance 5.2 Preventive Maintenance 5.3 Tooling Maintenance</p>	<p>5. Engineering Drawings and Sketches 5.1 Standard Orthographic prints 5.2 GDT Orthographic prints 5.3 GDT Datum, Symbology and Tolerances</p>
<p>6. Industrial Safety and Environmental Protection 6.1 Machine Operations and Material Handling 6.2 Hazardous Materials Handling and Disposal</p>	<p>6. Measurement 6.1 Basic Measuring Instruments 6.2 Precision Measuring Instruments 6.3 Surface Plate Instruments 6.4 Metric Conversion</p>
<p>7. Career Management and Employment Relations 7.1 Career Planning 7.2 Job Applications and Interviewing 7.3 Teamwork and Interpersonal Relations 7.4 Organizational Structures and Work Relations 7.5 Employment Relations</p>	<p>7. Metalworking Theory 7.1 Cutting Theory 7.2 Tooling 7.3 Material Properties 7.4 Machine Tools 7.5 Cutting Fluids and Coolants</p>

A Skills and Credentialing Framework for Careers in Metalworking in the United States

Capstone Opportunity Fields

Business Owner, Journeyman, General Management, Industrial Management, Engineering Technology, Engineering, Sales and Application Engineer



The credentialing processes involve performance reviews and written exams on related theory and other knowledge areas to demonstrate competencies.

Each skill set is based on the most important responsibilities that workers are expected to perform; the credentialing process is modular in design—workers or employers select the modules of skill sets that best meet their career direction or job requirements.



National Institute for Metalworking Skills, Inc.

Level I Machining Skills

Level I Machining Skills

Duty Area: 1. Job Planning and Management
Duty Title: 1.1 Job Process Planning

Duty:
Develop a process plan for a part requiring milling, drilling, turning, or grinding. Fill out an operation sheet detailing the process plan and required speeds and feeds.

Performance Standard:
Given a print detailing a part requiring milling, drilling, turning, and grinding, verbal instructions, and appropriate references, formulate a set of strategies to manufacture the part and fill out an operation sheet reflecting the chosen strategies including the required speeds and feeds.

Identify all major components and functions of the machine tools, and all major hand tools, measuring tools, tools and fixtures, work materials and provide the rationale for the speeds and feeds selected.

Note: The blueprint will require the execution of the machining operations described in duties 2.1 to 2.9.

Other Evaluation Criteria:

1. Legibility
2. Appropriate speeds and feeds

Accuracy Level: N/A.

Assessment Equipment and Material:

Workstation: Common workbench.

Material: A print with an appropriate part, an inventory of available tools.

Tooling: N/A.

Measuring Instruments: N/A.

Reference: Machinery's Handbook.

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Job Process Planning Duty.

	1. Written and Oral Communication		5. Engineering Drawings and Sketches
X	1.1 Reading	X	5.1 Standard Orthographic Prints
X	1.2 Writing		5.2 GDT Orthographic Prints
X	1.3 Speaking	X	5.3 GD&T Datums, Symbology and Tolerances
X	1.4 Listening		6. Measurements
	2. Mathematics	X	6.1 Basic Measurements
X	2.1 Arithmetic	X	6.2 Precision Measurements
X	2.2 Applied Geometry		6.3 Surface Plate Instruments
X	2.3 Applied Algebra	X	6.4 Metric Conversion
	2.4 Applied Trigonometry		7. Metalworking Theory
	2.5 Applied Statistics	X	7.1 Cutting Theory
	3. Decision Making and Problem Solving	X	7.2 Tooling
X	3.1 Applying Decision Rules	X	7.3 Material Properties
X	3.2 Basic Problem Solving	X	7.4 Machine Tools
	4. Group Skills and Personal Qualities	X	7.5 Cutting Fluids and Coolants
	4.1 Group Participation and Teamwork		
	4.2 Personal Qualities		

Duty Area: 2. Job Execution
Duty Title: 2.1 Manual Operations: Benchwork

Duty:
Using aluminum, hand drill and hand tap holes. Use hand drills, hand taps, tap wrench, files, scrapers, and coated abrasives to deburr parts. Use arbor presses to perform press fits. Use bench vises and hand tools appropriately.

Performance Standard:
Given a process plan, blueprint, access to hand tools, produce a part with two holes prepared for hand tapping, a hole prepared (reamed) for the press fit of a bushing, and a stud for one of the tapped holes. Deburr the part, hand drill and hand tap the holes, press in the bushing, and install the stud.

Other Evaluation Criteria:

1. Free of sharp edges or burrs.
2. Go/NoGo gage for the threads.
3. Length of stud within 1/32 of basic dimension and square to surface.

Accuracy Level: $\pm 1/64$ on all fractions, unless otherwise specified on the blueprint.

Assessment Equipment and Material:

Workstation: Common workbench with at least a four-inch bench vise, an arbor press.
Material: A part machined to the benchwork blueprint, material: Aluminum or mild steel A stud matching the requirements of the blueprint, and a selection of sleeve bushings for the desired fit, cutting oil, and appropriate lubricants.
Tooling: Taps, tap wrenches, assorted files with handles, assorted scrapers, reamer, hacksaw frame with an assortment of blades.
Measuring Instruments: Combination set, height gage or dial indicator, depth micrometer, and a 1/4-20 cap screw.
Reference: Machinery's Handbook.

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Benchwork Duty.

	1. Written and Oral Communication		5. Engineering Drawings and Sketches
X	1.1 Reading	X	5.1 Standard Orthographic Prints
X	1.2 Writing		5.2 GDT Orthographic Prints
X	1.3 Speaking	X	5.3 GDT Datums, Symbology and Tolerances
X	1.4 Listening		6. Measurements
	2. Mathematics	X	6.1 Basic Measurements
X	2.1 Arithmetic		6.2 Precision Measurements
	2.2 Applied Geometry		6.3 Surface Plate Instruments
	2.3 Applied Algebra	X	6.4 Metric Conversion
	2.4 Applied Trigonometry		7. Metalworking Theory
	2.5 Applied Statistics		7.1 Cutting Theory
	3. Decision Making and Problem Solving		7.2 Tooling
X	3.1 Applying Decision Rules	X	7.3 Material Properties
X	3.2 Basic Problem Solving		7.4 Machine Tools
	4. Group Skills and Personal Qualities		7.5 Cutting Fluids and Coolants
	4.1 Group Participation and Teamwork		
	4.2 Personal Qualities		

Note to Standards Readers:

The part will require the development of a 1/16 X 45° chamfer along a 3" edge and a 1/16 radius also along another 3" edge. The part will be no more than 1" thick. One of the holes to be tapped will be blind. Holes will be countersunk for tapping. The blueprint will specify a .001" press fit.

Duty Area: 2. **Job Execution**
Duty Title: 2.2 **Manual Operations: Layout**

Duty:
Layout the location of hole centers and surfaces within an accuracy of +/- .015.

Performance Standard:
Given a surface plate, surface gage, layout height gage, combination set, scribe, layout ink, prick punch, ball peen hammer, process plan, and part print, layout hole locations, radii, and surfaces matching the specifications.

Other Evaluation Criteria:

1. Layout ink is applied to the surface appropriately.
2. Lines are struck once.
3. Intersections are clean and clear.
4. Punch marks are centered on intersections.

Accuracy Level: +/- .015 on all fractions, unless otherwise specified on the blueprint.

Assessment Equipment and Material:

Workstation: Common workbench, a layout surface plate at least 12" X 18"

Material: A part matching the layout print, material: Cold rolled mild steel.

Tooling: A scribe, layout ink or a Magic Marker, prick punch, ball peen hammer, angle plate, C-clamps, parallel-closing clamps, magnifying glass.

Measuring Instruments: Combination set, radius gages, 6" dividers, surface gage, or layout height gage.

Reference: Machinery's Handbook.

Level I Machining Skills

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Layout Duty.

	1. Written and Oral Communication		5. Engineering Drawings and Sketches
X	1.1 Reading	X	5.1 Standard Orthographic Prints
X	1.2 Writing		5.2 GDT Orthographic Prints
X	1.3 Speaking	X	5.3 GDT Datums, Sumbology and Tolerances
X	1.4 Listening		6. Measurements
	2. Mathematics	X	6.1 Basic Measurements
X	2.1 Arithmetic	X	6.2 Precision Measurements
X	2.2 Applied Geometry	X	6.3 Surface Plate Instruments
	2.3 Applied Algebra	X	6.4 Metric Conversion
	2.4 Applied Trigonometry		7. Metalworking Theory
	2.5 Applied Statistics		7.1 Cutting Theory
	3. Decision Making and Problem Solving		7.2 Tooling
X	3.1 Applying Decision		7.3 Material Properties
X	3.2 Basic Problem Solving		7.4 Machine Tools
	4. Group Skills and Personal Qualities		7.5 Cutting Fluids and Coolants
	4.1 Group Participation		
	4.2 Personal Qualities		

Duty Area: 2. Job Execution
Duty Title: 2.3 Turning Operations: Between Centers Turning

Duty:

Setup and carry out between centers turning operations for straight turning.

Performance Standard:

Given raw material, process plan, part print, hand, precision, and cutting tools, as well as access to an appropriate turning machine and its accessories, produce a part matching the process plan and the part print specifications using appropriate trade techniques and speeds and feeds. The part specified should have at least three diameters within $\pm .002$, one UNC external thread, one UNF external thread, and require an end-for-end swap.

Other Evaluation Criteria:

1. Finishes are at least 125 microinches.
2. No sharp edges.

Accuracy Level: $\pm .015$ on all fractions, $\pm .005$ on all decimals unless otherwise specified on the part print. Diameters to be concentric within .002 T.I.R.

Assessment Equipment and Material:

Workstation: A common workbench, an engine lathe of 14"X 30" minimum capacity, a three-jaw universal scroll chuck, and a four-jaw independent chuck. The lathe may have a quick change gear box with the threads called for on the blueprint available from the gear box.

Material: A part matching the material requirements of the turning print, material: Mild steel.

Tooling: Tool post, right and left hand turning tools capable of turning to a square shoulder, an external threading tool matched to the profile of the thread called out on the turning blueprint, a drill chuck, combination drill and countersink, leg dog, external undercut tools, 45° chamfer tools, live center, dead center fitted to the spindle taper, magnetic base for a dial indicator, files, wrenches as necessary.

Measuring Instruments: Required micrometers, combination set, thread pitch gages, center gage, thread ring gages, dial indicator, 6" rule, 6" vernier, dial, or electronic caliper, surface finish comparison plates.

Reference: Machinery's Handbook.

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Between Centers Turning Duty.

	1. Written and Oral Communication		5. Engineering Drawings and Sketches
X	1.1 Reading	X	5.1 Standard Orthographic Prints
X	1.2 Writing		5.2 GDT Orthographic Prints
X	1.3 Speaking		5.3 GDT Datums, Symbology and Tolerances
X	1.4 Listening		6. Measurements
	2. Mathematics	X	6.1 Basic Measurements
X	2.1 Arithmetic	X	6.2 Precision Measurements
X	2.2 Applied Geometry		6.3 Surface Plate Instruments
X	2.3 Applied Algebra	X	6.4 Metric Conversion
	2.4 Applied Trigonometry		7. Metalworking Theory
	2.5 Applied Statistics	X	7.1 Cutting Theory
	3. Decision Making and Problem Solving	X	7.2 Tooling
X	3.1 Applying Decision	X	7.3 Material Properties
X	3.2 Basic Problem Solving	X	7.4 Machine Tools
	4. Group Skills and Personal Qualities	X	7.5 Cutting Fluids and Coolants
	4.1 Group Participation		
	4.2 Personal Qualities		

Duty Area: 2. Job Execution
Duty Title: 2.4 Turning Operations: Chucking

Duty:
Setup and carry out chucking operations for turning.

Performance Standard:

Given raw material, process plan, part print, hand, precision, and cutting tools, as well as access to an appropriate turning machine and its accessories, produce a part matching the process plan and the print specifications using appropriate trade techniques and speeds and feeds. The part specified should have at least three diameters within $\pm .005$ ", two bores within $\pm .005$ ", one UNC external thread, and require at least two chuckings or other workholding setup.

Other Evaluation Criteria:

1. Finishes are at least 125 microinches.
2. No sharp edges.

Accuracy Level: $\pm .015$ on all fractions, $\pm .005$ on all decimals unless otherwise specified on the blueprint. Diameters to be concentric within 002 T.I.R.

Assessment Equipment and Material:

Workstation: A common workbench, an engine lathe of 14"X 30" minimum capacity, a three jaw universal scroll chuck, and a four jaw independent chuck. The lathe may have a quick change gear box with the threads called for on the print available from the gear box.

Material: A part matching the material requirements of the turning blueprint, material: Mild steel.

Tooling: Tool post, right and left hand turning tools capable of turning to a square shoulder, an external threading tool matched to the profile of the thread called out on the turning print, a boring bar and boring tool capable of boring to a square shoulder, a drill chuck, centerdrill, and assorted drills necessary to rough out the bore, magnetic base for a dial indicator, spiders for chucks, files, wrenches as necessary.

Measuring Instruments: Required micrometers, combination set, thread pitch gages center gage, pitch micrometer, thread ring, dial indicator, 6" rule, a 6" vernier, dial, or electronic caliper, telescoping gages or inside calipers, and surface finish comparison plates.

Reference: Machinery's Handbook.

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Chucking Operations for Turning Duty.

	1. Written and Oral Communication		5. Engineering Drawings and Sketches
X	1.1 Reading	X	5.1 Standard Orthographic Prints
X	1.2 Writing		5.2 GDT Orthographic Prints
X	1.3 Speaking	X	5.3 GDT Datums, Symbology and Tolerances
X	1.4 Listening		6. Measurements
	2. Mathematics	X	6.1 Basic Measurements
X	2.1 Arithmetic	X	6.2 Precision Measurements
X	2.2 Applied Geometry		6.3 Surface Plate Instruments
X	2.3 Applied Algebra	X	6.4 Metric Conversion
	2.4 Applied Trigonometry		7. Metalworking Theory
	2.5 Applied Statistics	X	7.1 Cutting Theory
	3. Decision Making and Problem Solving	X	7.2 Tooling
X	3.1 Applying Decision	X	7.3 Material Properties
X	3.2 Basic Problem Solving	X	7.4 Machine Tools
	4. Group Skills and Personal Qualities	X	7.5 Cutting Fluids and Coolants
	4.1 Group Participation		
	4.2 Personal Qualities		

Note to Standards Readers:

Readers thus far have indicated that these operations should be chucking only. No tailstock support should be used in either chucking.

Duty Area: 2. Job Execution
Duty Title 2.5 Milling: Square Up a Block

Duty:

Set up and perform squaring up the six surfaces of a block to within +/- .002 and .002 over 4.5" squareness

Performance Standard:

Given raw material, process plan, part print, hand, precision and cutting tools, as well as access to an appropriate milling machine and its accessories produce a part matching the process plan and the part print specifications. The part will require squaring up from its raw state.

Accuracy level: +/- .002 on all decimals unless otherwise specified on the part print.
Surfaces square to within .002" over 4.5". 63 microinch finish

Assessment Equipment and Material:

Workstation A standard workbench and a milling machine.

Material: A part matching the material requirements of the part print; cold rolled steel

Tooling: A 6" milling vise or greater, screws, studs, nuts, washers, and clamps sufficient to secure the vise or the part to the table. Assorted parallels, ball peen, and composite hammers, assorted cutters and cutter adaptors fitted to the machine spindle, files, magnetic base for indicators, soft jaws for the vise and coolants and cutting fluids.

Measuring Instruments: Required micrometers, combination set, dial indicator, 6 inch Rule, a 6" vernier, dial, or electronic caliper, adjustable parallels, edge finder, Appropriate tools for determining squareness, and surface finish comparison standards.

Reference: Machinery's Handbook

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Squaring Up a Block Duty.

	1. Written and Oral Communication		5. Engineering Drawings and Sketches
X	1.1 Reading	X	5.1 Standard Orthographic Prints
X	1.2 Writing		5.2 GDT Orthographic Prints
X	1.3 Speaking	X	5.3 GDT Datums, Symbology and Tolerances
X	1.4 Listening		6. Measurements
	2. Mathematics	X	6.1 Basic Measurements
X	2.1 Arithmetic	X	6.2 Precision Measurements
X	2.2 Applied Geometry		6.3 Surface Plate Instruments
X	2.3 Applied Algebra	X	6.4 Metric Conversion
	2.4 Applied Trigonometry		7. Metalworking Theory
	2.5 Applied Statistics	X	7.1 Cutting Theory
	3. Decision Making and Problem Solving	X	7.2 Tooling
X	3.1 Applying Decision	X	7.3 Material Properties
X	3.2 Basic Problem Solving	X	7.4 Machine Tools
	4. Group Skills and Personal Qualities	X	7.5 Cutting Fluids and Coolants
	4.1 Group Participation		
	4.2 Personal Qualities		

Duty Area: 2. Job Execution
Duty Title: 2.6 Vertical Milling

Duty:
Setup and operate vertical milling machines. Perform routine milling, and location of hole centers within $\pm .005$ ".

Performance Standard:
Given raw material, process plan, print, hand, precision, and cutting tools, as well as access to an appropriate vertical milling machine and its accessories, produce a part matching the process plan and the blueprint specifications using appropriate trade techniques and speeds and feeds. The part specified should require squaring up from the raw state, have at least one milled slot, require the location of at least two drilled and reamed holes within $\pm .005$ " and have three steps controlled by tolerances of $\pm .005$ ".

Other Evaluation Criteria:

1. Finishes are at least 125 microinches.
2. No sharp edges.

Accuracy Level: $\pm .015$ on all fractions, $\pm .005$ on all decimals unless otherwise specified on the blueprint. Finishes Surfaces to be square within $.005$ over 4".
Finished surfaces are to be 125 microinches unless otherwise specified.

Assessment Equipment and Material:

Workstation: A common workbench, a vertical mill. Table capacity of approximately 12"X36".
Material: A part matching the material requirements of the vertical milling print, material: Mild steel.
Tooling: A 6" milling vise or greater, screws, studs, nuts, washers, and clamps sufficient to secure the vise, or the part to the table. Assorted parallels, ball peen, and soft-faced hammers, assorted cutters and cutter adapters fitted to the machine spindle, files, magnetic base for indicators, soft jaws for the vise, drill chuck, drills, reamers, combination drill and countersink or spotting drill, countersink, and edge finder. Coolants and cutting oil.
Measuring Instruments: 0-3 Micrometers, combination set, dial indicator, 6" rule, a 6" vernier, dial, or electronic caliper, adjustable parallels, and depth micrometer, and surface finish comparison plates.
Reference: Machinery's Handbook.

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Vertical Milling Duty.

	1. Written and Oral Communication		5. Engineering Drawings and Sketches
X	1.1 Reading	X	5.1 Standard Orthographic Prints
X	1.2 Writing		5.2 GDT Orthographic Prints
X	1.3 Speaking	X	5.3 GDT Datums, Symbology and Tolerances
X	1.4 Listening		6. Measurements
	2. Mathematics	X	6.1 Basic Measurements
X	2.1 Arithmetic	X	6.2 Precision Measurements
X	2.2 Applied Geometry		6.3 Surface Plate Instruments
X	2.3 Applied Algebra	X	6.4 Metric Conversion
	2.4 Applied Trigonometry		7. Metalworking Theory
	2.5 Applied Statistics	X	7.1 Cutting Theory
	3. Decision Making and Problem Solving	X	7.2 Tooling
X	3.1 Applying Decision	X	7.3 Material Properties
X	3.2 Basic Problem Solving	X	7.4 Machine Tools
	4. Group Skills and Personal Qualities	X	7.5 Cutting Fluids and Coolants
	4.1 Group Participation		
	4.2 Personal Qualities		

Duty Area: 2. Job Execution
Duty Title: 2.7a Surface Grinding, Grinding Wheel Safety

Duty:
Ring test grinding wheels, perform visual safety inspection, mount and dress a grinding wheel in preparation for surface grinding.

Performance Standard:
Given a selection of wheels in various conditions determine which are suitable for use, mount one on the spindle, and dress it in preparations for surface grinding.

Other Evaluation Criteria:

1. N/A.

Accuracy Level: N/A

Assessment Equipment and Material:

Workstation: A common workbench with a precision surface plate, a surface grinder.

Material: N/A

Tooling: A magnetic chuck, assorted grinding wheels suitable for mounting to the spindle, soft-faced hammer, assorted wrenches, screwdrivers, specialty hand tools for the spindle, and a diamond dresser.

Measuring Instruments: N/A

Reference: Machinery's Handbook

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Surface Grinding Wheel Safety Duty.

	1. Written and Oral Communication		5. Engineering Drawings and Sketches
X	1.1 Reading	X	5.1 Standard Orthographic Prints
X	1.2 Writing		5.2 GDT Orthographic Prints
X	1.3 Speaking		5.3 GDT Datums, Symbology and Tolerances
X	1.4 Listening		6. Measurements
	2. Mathematics	X	6.1 Basic Measurements
X	2.1 Arithmetic		6.2 Precision Measurements
X	2.2 Applied Geometry		6.3 Surface Plate Instruments
	2.3 Applied Algebra	X	6.4 Metric Conversion
	2.4 Applied Trigonometry		7. Metalworking Theory
	2.5 Applied Statistics	X	7.1 Cutting Theory
	3. Decision Making and Problem Solving	X	7.2 Tooling
X	3.1 Applying Decision	X	7.3 Material Properties
X	3.2 Basic Problem Solving	X	7.4 Machine Tools
	4. Group Skills and Personal Qualities	X	7.5 Cutting Fluids and Coolants
	4.1 Group Participation		
	4.2 Personal Qualities		

Duty Area: 2. Job Execution
Duty Title: 2.7b Surface Grinding, Horizontal Spindle,
Reciprocating Table

Duty:
Setup and operate manual surface grinders with a 8" and smaller diameter wheel. Perform routine surface grinding, location of surfaces, and squaring of surfaces. Perform wheel dressing.

Performance Standard:
Given a block squared up on a mill, a process plan, part print, hand and precision tools, and choice of a grinding wheels, as well as access to a surface grinder and its accessories, dress the wheel, produce a part matching the process plan and the print specifications using appropriate trade techniques. The part specified will be in the semi-finished state having been squared up. Finishing the part will require the precision finishing of the six faces of the block to tolerances common to precision grinding for squareness, size, and surface finish characteristics.

Other Evaluation Criteria:
1. Finishes are at least 32 microinches or better.
2. Free of sharp edges.

Accuracy Level: +/- .001 on all decimals unless otherwise specified on the print.
Square within .001 over 4".

Assessment Equipment and Material:

Workstation: A common workbench with a precision surface plate, a surface grinder with a suitable magnetic chuck..

Material: A part matching the material requirements of the surface grinding part print, material: Mild steel.

Tooling: A magnetic chuck, assorted parallels, a suitable angle plate or precision grinding vise, and assorted clamps, composition hammer, assorted grinding wheels suitable for mounting to the spindle, files, magnetic base for indicators, surface gage of sufficient size, and diamond dresser.

Measuring Instruments: Required micrometers, combination set, dial test indicator, 6" rule, a 6" vernier, dial, or electronic caliper, adjustable parallels, depth micrometer set, master square or magnetic square, surface finish comparison gages.

Reference: Machinery's Handbook

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Duty on using Surface Grinding, Horizontal Spindle, and a Reciprocating Table.

	1. Written and Oral Communication		5. Engineering Drawings and Sketches
X	1.1 Reading	X	5.1 Standard Orthographic Prints
X	1.2 Writing		5.2 GDT Orthographic Prints
X	1.3 Speaking	X	5.3 GDT Datums, Symbology and Tolerances
X	1.4 Listening		6. Measurements
	2. Mathematics	X	6.1 Basic Measurements
X	2.1 Arithmetic	X	6.2 Precision Measurements
X	2.2 Applied Geometry	X	6.3 Surface Plate Instruments
X	2.3 Applied Algebra	X	6.4 Metric Conversion
	2.4 Applied Trigonometry		7. Metalworking Theory
	2.5 Applied Statistics	X	7.1 Cutting Theory
	3. Decision Making and Problem Solving	X	7.2 Tooling
X	3.1 Applying Decision	X	7.3 Material Properties
X	3.2 Basic Problem Solving	X	7.4 Machine Tools
	4. Group Skills and Personal Qualities	X	7.5 Cutting Fluids and Coolants
	4.1 Group Participation		
	4.2 Personal Qualities		

Duty Area: 2. Job Execution
Duty Title: 2.8 Drill Press

Duty:

Setup and operate drill presses. Perform routine drill press operations.

Performance Standard:

Given a semi-finished part, process plan, part print, hand precision, and cutting tools, as well as access to a drill press and its accessories, produce a part matching the process plan and the blueprint specifications. The part specified will be in the semi-finished state having been squared up and the outer surfaces completed with five center-drilled locations. Finishing the part will require the finishing of the five center-drilled locations. Each hole must have at least two secondary operations. The secondary operations will consist of reaming, spot facing, countersinking, counterboring, and counterdrilling. At least one hole must be a blind hole and one a through hole. At least one hole will may be power tapped.

Other Evaluation Criteria:

1. Finishes are at least 250 microinches.
2. No sharp edges.
3. The mouths of all holes are lightly countersunk.

Accuracy Level:

+/- 1/64 on all fractions, holes square within .005 per inch, drilled diameters, +.006, -.000. Reamed diameters +.001, -.000, +/- .005 on all decimals unless otherwise specified on the blueprint.

Assessment Equipment and Material:

- Workstation:*** A common workbench, a drill press. Morse taper #3 spindle capacity or greater preferred. The drill press must have a tapping capability or a tapping head accessory.
- Material:*** A part matching the material requirements of the drill press blueprint, material: mild steel, cutting fluids.
- Tooling:*** A 6" drill vise or greater, screws, studs, nuts, washers, and clamps sufficient to secure the vise, or the part. Assorted parallels, a composition hammer, assorted Morse taper sleeves fitted to the machine spindle, drill chucks, drills, reamers, countersinks, spot facers, counterbores, centerdrills, and various taps. A scriber, layout ink, prick punch, ball peen hammer, angle plate, 6" dividers, surface gage.
- Measuring Instruments:*** Required micrometers, combination set, 6" rule, a 6" vernier, dial, or electronic caliper, go/nogo gage for threads, plug gages, telescoping gages, layout height gage, and surface finish comparison plates.
- Reference:*** Machinery's Handbook.

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Drill Press Duty.

	1. Written and Oral Communication		5. Engineering Drawings and Sketches
X	1.1 Reading	X	5.1 Standard Orthographic Prints
X	1.2 Writing		5.2 GDT Orthographic Prints
X	1.3 Speaking		5.3 GDT Datums, Symbology and Tolerances
X	1.4 Listening		6. Measurements
	2. Mathematics	X	6.1 Basic Measurements
X	2.1 Arithmetic	X	6.2 Precision Measurements
X	2.2 Applied Geometry		6.3 Surface Plate Instruments
X	2.3 Applied Algebra	X	6.4 Metric Conversion
	2.4 Applied Trigonometry		7. Metalworking Theory
	2.5 Applied Statistics	X	7.1 Cutting Theory
	3. Decision Making and Problem Solving	X	7.2 Tooling
X	3.1 Applying Decision	X	7.3 Material Properties
X	3.2 Basic Problem Solving	X	7.4 Machine Tools
	4. Group Skills and Personal Qualities	X	7.5 Cutting Fluids and Coolants
	4.1 Group Participation		
	4.2 Personal Qualities		

Note to Standards Readers:

The material for the drill press standard will be between 1/2 and 1 inch thick.

Duty Area: 2. Job Execution
Duty Title: 2.9 CNC Programming

Duty:
Using the principles of cartesian coordinates develop a program for the manufacture of a simple part.

Performance Standard:
Given a computer and a basic CNC software program, and a blueprint for part comparison. Apply the principles of three-dimensional coordinate planes in the development a simple program for the production of the part on a CNC milling machine.

Other Evaluation Criteria:
1. Free of sharp edges.

Accuracy Level: +/- 1/64".

Assessment Equipment and Material:

Workstation: Computer Workstation

Material: N/A

Tooling: N/A

Measuring Instruments: N/A

Reference: Machinery's Handbook. Software Manual

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the CNC Program Duty.

	1. Written and Oral Communication		5. Engineering Drawings and Sketches
X	1.1 Reading	X	5.1 Standard Orthographic Prints
X	1.2 Writing		5.2 GDT Orthographic Prints
X	1.3 Speaking	X	5.3 GDT Datums, Symbology and Tolerances
X	1.4 Listening		6. Measurements
	2. Mathematics		6.1 Basic Measurements
X	2.1 Arithmetic		6.2 Precision Measurements
	2.2 Applied Geometry		6.3 Surface Plate Instruments
	2.3 Applied Algebra	X	6.4 Metric Conversion
	2.4 Applied Trigonometry		7. Metalworking Theory
	2.5 Applied Statistics		7.1 Cutting Theory
	3. Decision Making and Problem Solving		7.2 Tooling
X	3.1 Applying Decision		7.3 Material Properties
X	3.2 Basic Problem Solving		7.4 Machine Tools
	4. Group Skills and Personal Qualities		7.5 Cutting Fluids and Coolants
	4.1 Group Participation		
	4.2 Personal Qualities		

Duty Area: 3. Quality Control and Inspection
Duty Title: 3.1 Part Inspection

Duty:

Develop an inspection plan and inspect simple parts using precision tools and techniques. Prepare reports on the compliance of the parts.

Performance Standard:

Given the necessary job process sheets for a part and verbal instructions, identify and select the required measuring instruments and conduct the required inspection procedure(s). Complete required written inspection report and make a decision to accept or reject component parts. Provide brief verbal explanation of inspection procedures, results, and decisions.

Note: Inspection procedures will include basic inspections of parts and measurement instruments defined in Duties 2.1 and 2.9.

Other Evaluation Criteria:

1. N/A

Accuracy Level: Within a 1/64th for fractions, within .001" for decimals

Assessment Equipment and Material:

Workstation: A common workbench with a small surface plate.

Material: A finished part matching the requirements of the part inspection blueprint.

Tooling: Inspection grade gage blocks, angle plates, and clamps.

Measuring Instruments: An appropriate assortment of basic, fixed, precision, and surface plate inspection tools.

Reference: Machinery's Handbook.

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Part Inspection Duty.

	1. Written and Oral Communication		5. Engineering Drawings and Sketches
X	1.1 Reading	X	5.1 Standard Orthographic Prints
X	1.2 Writing		5.2 GDT Orthographic Prints
X	1.3 Speaking	X	5.3 GDT Datums, Symbology and Tolerances
X	1.4 Listening		6. Measurements
	2. Mathematics	X	6.1 Basic Measurements
X	2.1 Arithmetic	X	6.2 Precision Measurements
X	2.2 Applied Geometry	X	6.3 Surface Plate Instruments
	2.3 Applied Algebra	X	6.4 Metric Conversion
	2.4 Applied Trigonometry		7. Metalworking Theory
	2.5 Applied Statistics	X	7.1 Cutting Theory
	3. Decision Making and Problem Solving	X	7.2 Tooling
X	3.1 Applying Decision	X	7.3 Material Properties
X	3.2 Basic Problem Solving	X	7.4 Machine Tools
	4. Group Skills and Personal Qualities	X	7.5 Cutting Fluids and Coolants
	4.1 Group Participation		
	4.2 Personal Qualities		

Note to Standards Readers:
 A broad consensus regarding whether filling out an inspection plan is essential at Technician I has not emerged. The question remains. Oral defense of the inspection plan has gained the most support at this time. The next most supported position is requiring the candidate to be able to: (1) fill out an inspection plan form, and (2) fill out a data collection sheet with the dimensions actually found on the part.

Duty Area: 3. Quality Control and Inspection
Duty Title: 3.2 Process Control

Duty:

Follow a sampling plan. Inspect the samples for the required data. Enter the data on appropriate charts. Graph the data. Respond to the warning conditions indicated by the process charts.

Performance Standard:

Given the necessary job process sheets for a part, verbal instructions, and the necessary charts and inspection tools, inspect parts according to the sampling plan, collecting the data required for the process control chart. Working with the supplied control and warning limits, place the data, produce new data as needed, graph the data, and take the Stop or Go actions as indicated by the results of producing the process control chart. Provide brief verbal explanation regarding the decision taken.

Note: Inspection procedures will include basic inspections of parts and measurement instruments defined in Duties 2.1 and 2.9.

Other Evaluation Criteria:

1.N/A

Accuracy Level: Within a 1/64th for fractions, within .001 for decimals.

Assessment Equipment and Material:

Workstation: A common workbench with a small surface plate.

Material: An appropriate population of product matching the part print specifications and broken up into discrete packages matching the requirements of the sampling plan. X-bar and R charts.

Tooling:

Measuring Instruments: Inspection tools sufficient to carry out the sampling and inspection plan.

Reference: Machinery's Handbook.

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Process Control Duty.

	1. Written and Oral Communication		5. Engineering Drawings and Sketches
X	1.1 Reading	X	5.1 Standard Orthographic Prints
X	1.2 Writing		5.2 GDT Orthographic Prints
X	1.3 Speaking		5.3 GDT Datums, Symbology and Tolerances
X	1.4 Listening		6. Measurements
	2. Mathematics	X	6.1 Basic Measurements
X	2.1 Arithmetic	X	6.2 Precision Measurements
X	2.2 Applied Geometry		6.3 Surface Plate Instruments
X	2.3 Applied Algebra	X	6.4 Metric Conversion
	2.4 Applied Trigonometry		7. Metalworking Theory
X	2.5 Applied Statistics	X	7.1 Cutting Theory
	3. Decision Making and Problem Solving	X	7.2 Tooling
X	3.1 Applying Decision	X	7.3 Material Properties
X	3.2 Basic Problem	X	7.4 Machine Tools
	4. Group Skills and Personal Qualities	X	7.5 Cutting Fluids and Coolants
X	4.1 Group Participation		
X	4.2 Personal Qualities		

Duty Area: 4. Process Adjustment and Improvement
Duty Title: 4.1 Process Adjustment-Single Part Production

Duty:

Analyze the performance of a single-part production process. Formulate process adjustments or improvements where appropriate. Where appropriate, notify supervision of the proposed adjustment and/or improvement. Where authorized, carry out the strategies for process adjustment and/or improvement.

Performance Standard:

Given a process plan, part print, inspection process plan, verbal instructions, the necessary tools and equipment, and a part having routine problems being processed, analyze the problem(s), propose a remedy(ies), having been given authorization to implement the process improvement(s), carry it out. Explain the corrective actions and the reasoning used to perform the diagnosis.

Other Evaluation Criteria:

1. N/A

Accuracy Level: +/- 1/64 on all fractions, holes square within .005 per inch, drilled diameters, +.006, -.000. Reamed diameters +.001, -.000, +/- .005 on all decimals unless otherwise specified on the blueprint.

Assessment Equipment and Material:

Workstation: A common workbench, a machine tool with a setup in use.

Material: A part matching the setup, material: Hot rolled mild steel, cutting fluids.

Tooling: Tooling necessary to the setup.

Measuring Instruments: Inspection tools appropriate to the problem presented.

Reference: Machinery's Handbook.

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Process Adjustment for Single Part Production Duty.

	1. Written and Oral Communication		5. Engineering Drawings and Sketches
X	1.1 Reading	X	5.1 Standard Orthographic Prints
X	1.2 Writing		5.2 GDT Orthographic Prints
X	1.3 Speaking		5.3 GDT Datums, Symbology and Tolerances
X	1.4 Listening		6. Measurements
	2. Mathematics	X	6.1 Basic Measurements
X	2.1 Arithmetic	X	6.2 Precision Measurements
X	2.2 Applied Geometry		6.3 Surface Plate Instruments
	2.3 Applied Algebra	X	6.4 Metric Conversion
	2.4 Applied Trigonometry		7. Metalworking Theory
	2.5 Applied Statistics	X	7.1 Cutting Theory
	3. Decision Making and	X	7.2 Tooling
X	3.1 Applying Decision	X	7.3 Material Properties
X	3.2 Basic Problem Solving	X	7.4 Machine Tools
	4. Group Skills and Personal Qualities	X	7.5 Cutting Fluids and Coolants
X	4.1 Group Participation		
	4.2 Personal Qualities		

Duty Area: 4. Process Adjustment and Improvement
Duty Title: 4.2 Participation in Process Improvement

Duty:

As a member of a process team, analyze the performance of a production process. With the team formulate process adjustments or improvements where appropriate. Where appropriate, notify supervision of the proposed adjustments and/or improvement. Where authorized, carry out the strategies for process adjustment and/or improvement.

Performance Standard:

Given a process plan, Part print, inspection process plan, verbal instructions, the necessary tools and equipment, and a routine production process having a problem(s), as a team member, analyze the problem(s), propose a remedy(ies), having been given authorization to implement the process improvement(s), carry it out. Carry out the cause and effort analysis by participating in the development of a fishbone diagram with the team. Explain the fishbone diagram, the corrective actions and the reasoning connecting the fishbone root cause analysis to the remedial actions taken.

Other Evaluation Criteria:

1. N/A

Accuracy Level: +/- 1/64 on all fractions, +/- .005 on all decimals unless otherwise specified on the blueprint.

Assessment Equipment and Material:

Workstation: A team conference area.

Material: Fishbone charts, flip charts, markerboard.

Tooling: Writing tools, markers

Measuring Instruments: Relevant measuring instruments for the problem posed.

Reference: Machinery's Handbook.

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Process Improvement Duty.

	1. Written and Oral Communication		5. Engineering Drawings and Sketches
X	1.1 Reading	X	5.1 Standard Orthographic Prints
X	1.2 Writing		5.2 GDT Orthographic Prints
X	1.3 Speaking		5.3 GDT Datums, Symbology and Tolerances
X	1.4 Listening		6. Measurements
	2. Mathematics	X	6.1 Basic Measurements
X	2.1 Arithmetic	X	6.2 Precision Measurements
X	2.2 Applied Geometry		6.3 Surface Plate Instruments
	2.3 Applied Algebra	X	6.4 Metric Conversion
	2.4 Applied Trigonometry		7. Metalworking Theory
X	2.5 Applied Statistics	X	7.1 Cutting Theory
	3. Decision Making and	X	7.2 Tooling
X	3.1 Applying Decision	X	7.3 Material Properties
X	3.2 Basic Problem Solving	X	7.4 Machine Tools
	4. Group Skills and Personal Qualities	X	7.5 Cutting Fluids and Coolants
X	4.1 Group Participation		
X	4.2 Personal Qualities		

Duty Area: 5. General Maintenance
Duty Title: 5.1 General Housekeeping and Maintenance

Duty:

Keep the duty station clean and safe for work. Keep the tools, workbenches, and manual equipment clean, maintained, and safe for work.

Performance Standard:

Given maintenance, cleaning, and housekeeping check lists, as well as verbal instructions, clean, maintain, and respond appropriately to safety hazards on all benchwork tools and conventional and CNC machine tools. Maintain the cleanliness of the general work area.

Other Evaluation Criteria:

1. N/A

Accuracy Level: N/A

Assessment Equipment and Material:

Workstation: A common workbench, and machine tool work area.

Material: N/A

Tooling: Brooms, brushes, vacuum cleaner, waste containers.

Measuring Instruments: N/A

Reference: OSHA guidelines.

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the General Housekeeping and Maintenance Duty.

	1. Written and Oral Communication		5. Engineering Drawings and Sketches
X	1.1 Reading		5.1 Standard Orthographic Prints
X	1.2 Writing		5.2 GDT Orthographic Prints
X	1.3 Speaking		6. Measurements
X	1.4 Listening		6.1 Basic Measurements
	2. Mathematics		6.2 Precision Measurements
	2.1 Arithmetic		6.3 Surface Plate Instruments
	2.2 Applied Geometry	X	6.4 Metric Conversion
	2.3 Applied Algebra		7. Metalworking Theory
	2.4 Applied Trigonometry	X	7.1 Cutting Theory
	2.5 Applied Statistics	X	7.2 Tooling
	3. Decision Making and	X	7.3 Material Properties
X	3.1 Applying Decision	X	7.4 Machine Tools
X	3.2 Basic Problem Solving	X	7.5 Cutting Fluids and Coolants
	4. Group Skills and Personal Qualities		
X	4.1 Group Participation		
X	4.2 Personal Qualities		

Note to Standards Readers:

This duty standard will be assessed by a checklist which will be employed as other appropriate duty standards are assessed. For example, while observing the candidate's work for duty standard 2.6 for milling, the examiner will also check the candidate against the checklist for this duty standard.

Duty Area: 5. General Maintenance
Duty Title: 5.2 Preventive Maintenance, Machine Tools

Duty:
Inspect and assess the general condition of an assigned machine tool. Make routine adjustments as necessary and as authorized. Report problems to supervision which are beyond the scope of authority. Carry out daily, weekly, and/ or monthly routine upkeep chores cited on checklists for a given machine tool.

Performance Standard:
Given the preventive maintenance procedures and schedules for a given machine tool, as well as sufficient instruction and experience to recognize maintenance problems, carry out routine maintenance, report problems which are beyond the scope of authority, fill out the history forms for tracking maintenance.

Other Evaluation Criteria:
1. N/A

Accuracy Level: N/A

Assessment Equipment and Material:

Workstation: A standard machine tool.

Material: Maintenance forms, oil, grease, and shop towels.

Tooling: Hand tools for minor adjustments of guards and tooling.

Measuring Instruments: 6" rule

Reference: Machinery's Handbook.

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Preventive Maintenance for Machine Tools Duty.

	1. Written and Oral Communication		5. Engineering Drawings and Sketches
X	1.1 Reading	X	5.1 Standard Orthographic Prints
X	1.2 Writing		5.2 GDT Orthographic Prints
X	1.3 Speaking		6. Measurements
X	1.4 Listening	X	6.1 Basic Measurements
	2. Mathematics		6.2 Precision Measurements
X	2.1 Arithmetic		6.3 Surface Plate Instruments
	2.2 Applied Geometry	X	6.4 Metric Conversion
	2.3 Applied Algebra		7. Metalworking Theory
	2.4 Applied Trigonometry	X	7.1 Cutting Theory
	2.5 Applied Statistics	X	7.2 Tooling
	3. Decision Making and	X	7.3 Material Properties
X	3.1 Applying Decision	X	7.4 Machine Tools
X	3.2 Basic Problem Solving	X	7.5 Cutting Fluids and Coolants
	4. Group Skills and Personal Qualities		
X	4.1 Group Participation		
X	4.2 Personal Qualities		

Duty Area: 5. General Maintenance
Duty Title: 5.3 Tooling Maintenance

Duty:
Inspect and assess the condition of tooling. Refurbish tooling where appropriate. Refer tooling for repair or regrind where appropriate.

Performance Standard:

Given samples of tooling in various conditions, diagnose the tooling, take the correct steps to put the tooling back in service. The sample tooling should include turning, milling, and drilling tools. These tools should be both insert tooling as well as conventional tooling. The technician must demonstrate the offhand grinding of a drill between the diameter of .125" and 1.000". The offhand regrinding of a turning tool and the correct rotation and replacement of inserts in an insert style milling cutter body must be demonstrated. The technician must demonstrate the ability to recognize when a cutter should be referred to a tool and cutter grinder.

Other Evaluation Criteria:

1. The technician properly prepares the grinding wheel for grinding operations.
2. The drills produce holes within .005 of their nominal size.
3. The turning tool cuts freely and can be used to produce a finish of 125 microinches.
4. The technician observes the need for cleanliness when working on the cutter body.
5. Using an indicator, all inserts can be demonstrated to be at the same height within .001.
6. Placing the cutter into service, the inserts all cut as designed to do.

Accuracy Level: +/- 1/64 on all fractions, drilled diameters, +.006, -.000.

Proposed Time: 60 minutes. 15 minutes to grind two drills. 10 minutes to regrind a turning tool. 15 minutes to diagnose a variety of cutter's condition and orally report the recommended action to be taken. 20 minutes to rotate, replace, reseal inserts, or take other appropriate steps to prepare a six to eight inch face mill for return to service.

Assessment Equipment and Material:

Workstation: A common workbench, a pedestal grinder.

Material: N/A

Tooling: Drills, milling cutter bodies with inserts, turning tool blanks, wrenches for cutter bodies.

Measuring Instruments: Required micrometers, combination set, 6" rule, a 6" vernier, dial or electronic caliper, plug gages, telescoping gages, and layout height gage, dial indicator and base, and surface plate.

Reference: Machinery's Handbook.

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Tooling Maintenance Duty.

	1. Written and Oral Communication		5. Engineering Drawings and Sketches
X	1.1 Reading		5.1 Standard Orthographic Prints
X	1.2 Writing		5.2 GDT Orthographic Prints
X	1.3 Speaking		6. Measurements
X	1.4 Listening	X	6.1 Basic Measurements
	2. Mathematics	X	6.2 Precision Measurements
X	2.1 Arithmetic		6.3 Surface Plate Instruments
X	2.2 Applied Geometry	X	6.4 Metric Conversion
	2.3 Applied Algebra		7. Metalworking Theory
	2.4 Applied Trigonometry	X	7.1 Cutting Theory
	2.5 Applied Statistics	X	7.2 Tooling
	3. Decision Making and	X	7.3 Material Properties
X	3.1 Applying Decision	X	7.4 Machine Tools
X	3.2 Basic Problem Solving	X	7.5 Cutting Fluids and Coolants
	4. Group Skills and Personal Qualities		
	4.1 Group Participation		
	4.2 Personal Qualities		

Duty Area: 6. Industrial Safety and Environmental Protection
Duty Title: 6.1 Machine Operations and Material Handling

Duty:

Carry out assigned responsibilities while adhering to safe practices in accordance with OSHA requirements and guidelines. Document safety activities as required.

Performance Standard:

Given written and verbal safety instructions and checklists based on OSHA requirements and guidelines, demonstrate safe workplace practices in material handling, machine operations, handling of tooling, handling and application of coolants, cutting fluids and lubricants. Orally explain the actions taken which directly or indirectly bear upon safe practice in the execution of duties 2.1 through 2.9.

Other Evaluation Criteria:

1. N/A

Accuracy Level: Completion of all checklist items

Assessment Equipment and Material:

Workstation: N/A

Material: Appropriate materials and containers.

Tooling: Appropriate handling devices.

Measuring Instruments: N/A

Reference: OSHA guidelines.

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Machine Operations and Material Handling Duty.

	1. Written and Oral Communication		5. Engineering Drawings and Sketches
X	1.1 Reading	X	5.1 Standard Orthographic Prints
X	1.2 Writing		5.2 GDT Orthographic Prints
X	1.3 Speaking		6. Measurements
X	1.4 Listening	X	6.1 Basic Measurements
	2. Mathematics		6.2 Precision Measurements
X	2.1 Arithmetic		6.3 Surface Plate Instruments
	2.2 Applied Geometry	X	6.4 Metric Conversion
	2.3 Applied Algebra		7. Metalworking Theory
	2.4 Applied Trigonometry	X	7.1 Cutting Theory
	2.5 Applied Statistics	X	7.2 Tooling
	3. Decision Making and	X	7.3 Material Properties
X	3.1 Applying Decision	X	7.4 Machine Tools
X	3.2 Basic Problem Solving	X	7.5 Cutting Fluids and Coolants
	4. Group Skills and Personal Qualities		
	4.1 Group Participation		
	4.2 Personal Qualities		

Note to Standards Readers:

Lockout and right-to-know will be accounted for in 6. Material handling here means handling of shafts and overhead cranes etc., and personal protection. The candidate should recognize pinch points, cutting points, and control points. The Examiner will be supplied with safety and other kinds of observation checklists to ensure consistency and thoroughness.

Duty Area: 6. Industrial Safety and Environmental Protection
Duty Title: 6.2 Hazardous Materials Handling and Storage

Duty:

Handle and store hazardous materials as assigned while adhering to safe practices in accordance with OSHA and EPA requirements and guidelines. Document safety activities as required.

Performance Standard:

Given written and verbal safety instructions detailing the handling and storage of hazardous materials in compliance with OSHA and EPA requirements and guidelines, demonstrate safe workplace practices in the identification, handling, and storage of hazardous materials.

Other Evaluation Criteria:

1. N/A

Accuracy Level: N/A

Assessment Equipment and Material:

Workstation: N/A

Material: A hazardous material and appropriate containers.

Tooling: Appropriate handling devices.

Measuring Instruments: Appropriate material identification instruments. Instruments for the measurement of concentration.

Reference: Machinery's Handbook, relevant EPA and OSHA requirements and guidelines.

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Hazardous Materials Handling and Storage Duty.

	1. Written and Oral Communication		5. Engineering Drawings and Sketches
X	1.1 Reading		5.1 Standard Orthographic Prints
X	1.2 Writing		5.2 GDT Orthographic Prints
X	1.3 Speaking		6. Measurements
X	1.4 Listening	X	6.1 Basic Measurements
	2. Mathematics		6.2 Precision Measurements
X	2.1 Arithmetic		6.3 Surface Plate Instruments
	2.2 Applied Geometry	X	6.4 Metric Conversion
	2.3 Applied Algebra		7. Metalworking Theory
	2.4 Applied Trigonometry	X	7.1 Cutting Theory
	2.5 Applied Statistics	X	7.2 Tooling
	3. Decision Making and	X	7.3 Material Properties
X	3.1 Applying Decision	X	7.4 Machine Tools
X	3.2 Basic Problem Solving	X	7.5 Cutting Fluids and Coolants
	4. Group Skills and Personal Qualities		
X	4.1 Group Participation		
X	4.2 Personal Qualities		

Duty Area: 7. Career Management and Employment Relations

Duty Title: 7.1 Career Planning

Duty:

Develop and explain a short-term career plan and resume.

Performance Standard:

Given written information, presentations, and informational interviews with industry representatives on career opportunities in the metalworking industry, develop a short-term career plan (1-4 years) including career objectives, training and education, and employment opportunities. Develop a resume appropriate for the metalworking industry based on the career plan. Make an oral presentation of the career plan and resume.

Duty Area: 7. Career Management and Employment Relations

Duty Title: 7.2 Job Application and Interviewing

Duty:

Complete job application form and demonstrate interviewing skills.

Performance Standard:

Given a job description and a standard application, complete the application form. Identify and demonstrate appropriate interviewing skills in a face-to-face interview with a company representative.

Duty Area: 7. Career Management and Employment Relations

Duty Title: 7.3 Teamwork and Interpersonal Relations

Duty:

Demonstrate appropriate interpersonal skills in job performance evaluations, group communication and decision-making, and conflict resolution.

Performance Standard:

Given written and oral information about a machining technician job in a work unit, demonstrate appropriate interpersonal skills in three simulated cases involving a supervisor or team leader and other team members: (1) receiving feedback on job performance in a formal evaluation process, (2) actively participating in a group decision-making process involving appropriate communication and feedback skills with other team members, and (3) resolving conflicts with supervisors and team members.

Note: The second simulation will be related to the performance of Duty Standard 4.2- Participation in Process Improvement.

Duty Area: 7. Career Management and Employment Relations
Duty Title: 7.4 Organizational Structures and Work Relations

Duty:

Identify and explain the major departments or functions in a metalworking company and how they affect production units.

Performance Standard:

Given written materials and a formal orientation to a metalworking company for machining technicians, explain the major responsibilities of each department or unit in the company and the effect of each unit on the job performance of machining technicians in production jobs. Answer five questions about how common production problems affect these other units in the company.

Duty Area: 7. Career Management and Employment Relations
Duty Title: 7.5 Employment Relations

Duty:

Understand and explain employment rights and responsibilities in metalworking companies.

Performance Standard:

Given written and verbal information on employment rights and responsibilities (similar to those contained in employee handbooks), answer questions about hiring and promotion requirements, dismissal and layoff policies, compensation schedules and amounts, and substance abuse policies.

Knowledge, Skills, Abilities, and Other Characteristics

- KSAO Area:** **1. Written and Oral Communication**
KSAO: **1.1 Reading**

KSAO Definition:

Locates, understands, and interprets written technical and non-technical information in documents commonly found in the metalworking industry. These documents contain short and simple sentences, paragraphs and passages, phrases, quantitative information, specialized vocabulary, graphs, charts, schedules, simple instructions, and multi-step directions. All documents are written in standard English.

Performance Requirement:

Given a specific duty to perform and the necessary written information contained on relevant documents and information sheets, locate and read the necessary information and use this information to plan, execute, and evaluate the duty and answer questions about the content or meaning of the written information.

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the Reading KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan.	Read part prints. Read tool crib inventory. Read the Handbook.
2. Job execution	Benchwork Layout Operate machine tools	Read part prints. Read process plans. Read the Handbook.
3. Quality and inspection	Inspection Control	Read part prints. Read inspection plan. Read sampling plan. Read charting instructions.
4. Process improvement	Process adjustment Participation in improvement	Read part prints. Read process plans. Read the Handbook. Read team documents.
5. Maintenance	Housekeeping Machine tool PM Tooling maintenance	Read checklists. Read manuals.
6. Safety and environment	Operations and handling Haz-Mat handling & storage Material storage	Read safety instructions.

- KSAO Area:** 1. **Written and Oral Communication**
KSAO: 1.2 **Writing**

KSAO Definition:

Communicates technical and non-technical information, messages, and ideas in writing using standard English commonly found in the metalworking industry. This writing includes the completion of forms, information sheets, reports, group meeting materials, and short memos.

Performance Requirement:

Given a specific duty to perform and the necessary instructions, forms, and materials to complete the writing requirements for that duty, complete the writing requirement.

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the Writing KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan	Write instructions on the process plan.
2. Job execution	Benchwork Layout Operate machine tools	Write a record of job activities.
3. Quality and inspection	Inspection Control	Write a record of inspection activities.
4. Process improvement	Process adjustment Participation in improvement	Write a record of adjustment and improvement activities.
5. Maintenance	Housekeeping Machine tool PM Tooling maintenance	Write a record of maintenance activities. Fill out history forms.
6. Safety and environment	Operations and handling HazMat handling & storage Material storage	Write a record of the activities involving the handling and storage of standard and hazardous materials.

KSAO Area: 1. **Written and Oral Communication**
KSAO: 1.3 **Speaking**

KSAO Definition:

Communicates technical and non-technical detailed information, messages, multi-step directions and ideas through oral communication using standard English and related cues and communication aids in conversations, discussions, and group meetings. Understands and responds to listener feedback and asks questions when needed in two-way and group conversations.

Performance Requirement:

Given a specific duty to perform and the necessary instructions, written documents, and communication aids and materials to complete the speaking requirements for that duty, complete the speaking requirement.

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the Speaking KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan	Verbally explain the process plan.
2. Job execution	Benchwork Layout Operate machine tools	Explain job execution activities.
3. Quality and inspection	Inspection Control	Explain inspection procedures. Explain control charts and their role in process control.
4. Process improvement	Process adjustment Participation in improvement	Propose process remedies. Explain the selected corrective actions. Explain fishbone charts. Explain root cause reasoning.
5. Maintenance	Housekeeping Machine tool PM Tooling maintenance	Explain the condition of machine tools and the maintenance actions taken.
6. Safety and environment	Operations and handling HazMat handling & storage Material storage	Explain actions bearing on safe practice.

- KSAO Area:** 1. **Written and Oral Communication**
KSAO: 1.4 **Listening**

KSAO Definition:

Listens for, receives, interprets, and recalls specific details, ideas, and multi-step instructions in verbal presentations, conversations, discussions, and group meetings conducted in standard English and supported by written materials and other communication cues and aids. Uses active listening skills in comprehending simple technical and non-technical verbal information.

Performance Requirement:

Given a specific duty to perform and the necessary written information contained on relevant documents and information sheets, listen for, comprehend, and incorporate oral information in the performance of the duty and answer questions about the content or meaning of the oral information.

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the Listening KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan	Listen to verbal instructions.
2. Job execution	Benchwork Layout Operate machine tools	Listen to verbal instructions.
3. Quality and inspection	Inspection Control	Listen to verbal instructions.
4. Process improvement	Process adjustment Participation in improvement	Listen to verbal instructions.
5. Maintenance	Housekeeping Machine tool PM Tooling maintenance	Listen to verbal instructions.
6. Safety and environment	Operations and handling HazMat handling & storage Material storage	Listen to verbal instructions.

KSAO Area: 2. Mathematics
KSAO: 2.1 Arithmetic

KSAO Definition:

Performs addition, subtraction, multiplication, and division of whole numbers without a calculator, and performs calculation of fractions and decimals, as well as conversion to metric measurement with or without a calculator.

Performance Requirement:

Given a specific duty to perform requiring arithmetic operations, conduct arithmetic operations.

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the Arithmetic KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan.	Calculate speeds and feeds. Calculate operation times.
2. Job execution	Benchwork Layout Operate machine tools	Calculate necessary dimensions from the part print.
3. Quality and inspection	Inspection Control	Calculate necessary dimensions from the part print. Calculate statistics required by control charts.
4. Process improvement	Process adjustment Participation in improvement	Calculate the impact of a change of speed or feed.
5. Maintenance	Housekeeping Machine tool PM Tooling maintenance	Calculate the length of time spent in a PM activity.
6. Safety and environment	Operations and handling HazMat handling & storage Material storage	Calculate the volume of material stored.

KSAO Area: **2. Mathematics**
KSAO: **2.2 Applications of Geometry**

KSAO Definition:

Understands and applies basic geometric concepts and terminology which form the analytical foundation of job planning and execution including planes perpendicularity, Cartesian coordinates, concentricity, parallelism, straightness, flatness, circularity, and symmetry, etc.

Performance Requirement:

Given a specific duty to perform requiring the understanding and use of geometric concepts and terminology, perform the required duty and answer questions about the meaning and use of the geometric principles.

Duty standard Cross Reference Table:

This table identifies some of the activities that require the Applications of Geometry KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan	Apply geometry to select and sequence operations.
2. Job execution	Benchwork Layout Operate machine tools	Apply geometry to hold the work appropriately. Apply geometry to produce surfaces correctly.
3. Quality and inspection	Inspection Control	Apply geometry to locate surfaces and centerlines.
4. Process improvement	Process adjustment Participation in improvement	Apply geometry in analyzing operations and sequences.
5. Maintenance	Housekeeping Machine tool PM Tooling maintenance	Apply geometry in troubleshooting a machine tool or cutting tool.

KSAO Area: 2. Mathematics
KSAO: 2.3 Applications in Algebra

KSAO Definition:

Uses standard formulas and arithmetic operations to make required calculations with or without a calculator. Can solve for an unknown in a trade formula.

Performance Requirement:

Given a specific duty to perform requiring the use of formulas and arithmetic operations, conduct the required arithmetic operations using standard formulas.

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the Applications in Algebra KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan.	Use trade formulas.
2. Job execution	Benchwork Layout Operate machine tools	Use trade formulas.
3. Quality and inspection	Inspection Control	Use trade formulas.

KSAO Area: 2. Mathematics
KSAO: 2.4 Applications in Trigonometry

KSAO Definition:

Uses standard formulas and arithmetic operations to make required calculations with or without a calculator, solving for unknowns in right triangles.

Performance Requirement:

Given a specific duty to perform requiring the use of formulas and arithmetic operations, conduct the required arithmetic operations using standard formulas.

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the Applications in Trigonometry KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan.	Use trig-based trade formulas.
2. Job execution	Benchwork Layout Operate machine tools	Use trig-based trade formulas.
3. Quality and inspection	Inspection Control	Use trig-based trade formulas.

KSAO Area: 2. Mathematics
KSAO: 2.5 Applications of Statistics

KSAO Definition:

Uses standard formulas and arithmetic operations to calculate means, medians, modes, and ranges with or without a calculator.

Performance Requirement:

Given a specific duty to perform requiring the use of formulas and arithmetic operations, conduct the required statistical calculations using standard formulas.

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the Applications of Statistics KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan.	Use SPC as part of a process plan.
3. Quality and inspection	Inspection Control	Use SPC to control quality.
4. Process improvement	Process adjustment Participation in improvement	Use SPC to analyze process performance.
6. Safety and environment	Operations and handling HazMat handling & storage Material storage	Use SPC to evaluate safety performance.

- KSAO Area:** **3. Decision Making and Problem Solving**
KSAO: **3.1 Applying Decision Rules**

KSAO Definition:

Can follow a set of instructions laid out in a sequence. Can interpret and follow "if....then...." instructions.

Performance Requirement:

Given a specific duty to perform requiring a checklist of sequential instructions, carry out the duty making appropriate entries on the checklist.

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the Applying Decision Rules KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan.	Sequence operations.
2. Job execution	Benchwork Layout Operate machine tools	Follow the process plan, deviating according to decision rules where necessary.
3. Quality and inspection	Inspection Control	Follow the quality plan, deviating according to decision rules where necessary.
4. Process improvement	Process adjustment Participation in improvement	Apply checklists and decision rules to process improvement.
5. Maintenance	Housekeeping Machine tool PM Tooling maintenance	Apply company procedures to housekeeping, PM, and TM.
6. Safety and environment	Operations and handling HazMat handling & storage Material storage	Apply OSHA and EPA decision rules to the storage and handling of materials.

- KSAO Area:** **3. Decision Making and Problem Solving**
KSAO: **3.2 Basic Problem Solving**

KSAO Definition:

Can establish new responses to unexpected problems of a simple nature. Can formulate the new responses into a sequence of instructions or a set of "if ... then ..." rules.

Performance Requirement:

Given a specific duty to perform and being furnished with a checklist of sequential instructions, carry out the duty according to the checklist responding appropriately to problems. Formulate those responses into "if ... then ..." rules.

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the Basic Problem Solving KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan.	Sequence operations, providing alternatives according to availability of tools and equipment.
2. Job execution	Benchwork Layout Operate machine tools	Follow a process plan, improvising new methods where unavailability of tooling makes the plan obsolete.

- KSAO Area:** **4. Social Skills and Personal Qualities**
KSAO: **4.1 Social Skills**

KSAO Definition:

Identify and demonstrate the appropriate social skills and related personal qualities in the performance of major duties requiring cooperative relations with supervisors, team leaders, and team members.

Performance Requirement:

Demonstrates understanding, friendliness, politeness, and empathy toward others including men and women, and with people from a variety of ethnic, social, and educational backgrounds. Works cooperatively with others and contributes to group efforts with ideas, suggestions, and positive feedback to group members. Demonstrates appropriate social and communication skills in resolving conflicts with supervisors, team leaders, and team members.

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the Social Skills KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan.	Work cooperatively in developing a process plan, taking input from supervisors and coworkers.
2. Job execution	Benchwork Layout Operate machine tools	Work cooperatively by responding to the need to share common work spaces.
3. Quality and inspection	Inspection Control	Work cooperatively by participating in cooperative SPC activities.
4. Process improvement	Process adjustment Participation in improvement	Work cooperatively in workgroups, developing process improvements.
5. Maintenance	Housekeeping Machine tool PM Tooling maintenance	Work cooperatively by returning common tools to their appropriate storage sites.

KSAO Area: 4. **Social Skills and Personal Qualities**
KSAO: 4.2 **Personal Qualities**

KSAO Definition:

Identify and demonstrate the appropriate personal qualities in performing major job duties and maintaining positive employment relations.

Performance Requirement:

Recognizes and demonstrates appropriate codes of conduct and values in the workplace and demonstrates honesty and integrity in exhibiting appropriate workplace behaviors. Assumes responsibility and demonstrates strong work ethic by exerting effort and perseverance in doing work tasks according to high standards. Maintains high standards of attendance, punctuality, and involvement in all major work tasks.

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the Personal Qualities KSAO.

Duty Area	Task	Activity
3. Quality and inspection	Inspection Control	Demonstrates honesty and integrity in reporting the findings of inspection processes.
4. Process improvement	Process adjustment Participation in improvement	Demonstrates attendance and punctuality in attending meetings for the development of process improvement.
6. Safety and environment	Operations and handling HazMat handling & storage Material storage	Demonstrates honesty and perseverance in the handling of materials according to EPA requirements.

KSAO Area: 5. Engineering Drawings and Sketches
KSAO: 5.1 Standard Orthographic Prints

KSAO Definition:

Interprets orthographic blueprints.

Performance Requirement:

Given a standard orthographic print and a finished part from that print, prepare a checklist of dimensions necessary to determine the part's compliance.

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the Standard Orthographic Blueprint KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan.	Gather geometric and dimensional data from a print to sequence operations.
2. Job execution	Benchwork Layout Operate machine tools	Gather geometric and dimensional data from a print to perform a layout.
3. Quality and inspection	Inspection Control	Gather geometric and dimensional data from a print to perform the inspection of a finished part.

KSAO Area: 5. Engineering Drawings and Sketches
KSAO: 5.2 GDT Orthographic Prints

KSAO Definition:

Interprets GDT orthographic prints.

Performance Requirement:

Given a GDT print and a finished part from that print, prepare a checklist of dimensions necessary to determine the part's compliance.

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the GDT Orthographic Prints KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan.	Gather geometric and dimensional data from a GDT print to sequence operations.
2. Job execution	Benchwork Layout Operate machine tools	Gather geometric and dimensional data from a GDT print to perform a layout.
3. Quality and inspection	Inspection Control	Gather geometric and dimensional data from a GDT print to perform the inspection of a finished part.

KSAO Area: 5. Engineering Drawings and Sketches
KSAO: 5.3 Datums, Symbology and Tolerances

KSAO Definition:

Identify the common symbols, the use of datum references and tolerances used in GD&T

Performance Requirement:

Given a GDT blueprint identify the meaning of various given symbols and datum planes.
 Identify part dimensions using GD&T tolerances.

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the GDT Datum, Symbology and Tolerancing KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan.	Using symbols and tolerances identify basic contours of a part
2. Quality and inspection	Inspection Control	Gather geometric and dimensional data from a GDT blueprint to perform the inspection of a finished part.

KSAO Area: 6. Measurement
KSAO: 6.1 Basic Measuring Instruments

KSAO Definition:

Recognizes and applies basic measuring instruments such as rules, protractors, and basic transfer tools such as simple inside and outside calipers.

Performance Requirement:

Given a print and a finished part from that print, as well as a selection of appropriate basic measuring instruments, determine a part's compliance on selected dimensions.

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the Basic Measurement Instruments KSAO.

Duty Area	Task	Activity
2. Job execution	Benchwork Layout Operate machine tools	Set the length of layout tools using basic instruments.
3. Quality and inspection	Inspection Control	Inspect dimensions which call for the use of basic measuring tools on a finished part.

KSAO Area: 6. Measurement
KSAO: 6.2 Precision Measuring Instruments

KSAO Definition:

Recognizes and applies precision measuring instruments such as micrometers, vernier, dial, and electronic calipers, dial indicators, precision transfer tools such as telescoping gages and adjustable parallels.

Performance Requirement:

Given a print and a finished part from that print, as well as a selection of appropriate precision tools, determine a part's compliance on selected dimensions.

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the Precision Measuring Instruments KSAO.

Duty Area	Task	Activity
2. Job execution	Benchwork Layout Operate machine tools	Determine the concentricity of a turned part to a lathe's spindle using an indicator.
3. Quality and inspection	Inspection Control	Inspect the dimensions of a finished part which call for the use of precision measuring tools.

KSAO Area: 6. Measurement
KSAO: 6.3 Surface Plate Instruments

KSAO Definition:

Recognizes and applies appropriately precision tools and instruments for surface plate work such as precision angle plates and tool blocks, precision transfer gages, and precision height gages.

Performance Requirement:

Given a print and a finished part from that print, as well as a surface plate and a selection of appropriate surface plate instruments, determine a part's compliance on selected dimensions.

Duty standard Cross Reference Table:

This table identifies some of the activities that require the Surface Plate Instruments KSAO.

Duty Area	Task	Activity
3. Quality and inspection	Inspection Control	Inspect a part using surface plate instruments.

KSAO Area: 6. Measurement
KSAO: 6.4 Metric Conversion

KSAO Definition:

Convert all measurements to metrics.

Performance Requirement:

Given a part print with English tolerances shown. Convert all tolerances to metrics

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the Metric Conversion KSAO.

Duty Area	Task	Activity
2. Job execution	Benchwork Layout Operate machine tools	Determine part tolerances in metrics
3. Quality and inspection	Inspection Control	Inspect the dimensions of a finished part to metric tolerances

KSAO Area: 7. **Metalworking Theory**
KSAO: 7.1 **Cutting Theory**

KSAO Definition:

Understands and can explain the ideas of heat, shock, friction, zone of distortion, cutting interface, machinability, cutter presentation, cutter geometry, and chip-holding capacity as they relate to machining applications.

Performance Requirement:

Given a print and a part to be made, select speeds, feeds, and appropriate tooling to carry out the manufacture of the part.

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the Cutting Theory KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan	Determine speeds and feeds.
2. Job execution	Benchwork Layout Operate machine tools	Select cutters appropriate to machine operations.

KSAO Area: 7. Metalworking Theory

KSAO: 7.2 Tooling

KSAO Definition:

Recognizes a wide variety of cutting tools, tool holding devices, and work holding devices. Understands the appropriate application of these cutters and devices.

Performance Requirement:

Given a print and a part to be made, select appropriate tooling, tool-holders, and work-holding devices to carry out the manufacture of the part.

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the Tooling KSAO.

Duty Area	Task	Activity
2. Job execution	Benchwork Layout Operate machine tools	Select cutters, tool holders, and work-holders appropriate to machine operations.

KSAO Area: 7. Metalworking Theory

KSAO: 7.3 Material Properties

KSAO Definition:

Recognizes common materials and their principal properties relevant to machining tasks.
 Recognizes differences between ferrous and non-ferrous, magnetic, and ductile materials.
 Understands the changes which heat-treat impart to materials.

Performance Requirement:

Given a print and a part to be manufactured, predict its machinability based upon its appearance, call-out on the print, and its supplied hardness value.

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the Material Properties KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan	Predict speeds and feeds, as well as tooling requirements, based on known properties of a material.
2. Job execution	Benchwork Layout Operate machine tools	Respond to cutting conditions imposed by material properties as predicted by the process plan and actually experienced in machining the material.

KSAO Area: 7. Metalworking Theory
KSAO: 7.4 Machine Tools

KSAO Definition:

Recognizes the common classes of machine tools, understands the function of the major subsystems of the machine tools, selects and applies a given machine tool appropriately.

Performance Requirement:

Given a selection of machine tools, a print, and a part to be machined, identify the appropriate machine. Explain the selection and what distinguished that choice from the other possibilities.

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the Machine Tools KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan.	Select appropriate machine tools for a given set of operations.
2. Job execution	Benchwork Layout Operate machine tools	Operate machine tools to execute a specific operation.
3. Quality and inspection	Inspection Control	Participate in a machine-capability study.

KSAO Area: 7. Metalworking Theory
KSAO: 7.5 Cutting Fluids and Coolants

KSAO Definition:

Recognizes, selects, and applies appropriate coolants and coolant delivery systems.

Performance Requirement:

Given a set of machining operations, identify the appropriate coolant and delivery system for the operations.

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the Cutting Fluids and Coolants KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan.	Select appropriate coolants and delivery systems for a given set of operations.
2. Job execution	Benchwork Layout Operate machine tools	Operate machine tools to execute a specific operation using specified coolants and coolant delivery systems.

KSAO 8.1 Word Address Program Codes

KSAO Definition:

Develop a knowledge of basic word address programming codes, and Cartesian Coordinates Understand incremental and absolute positioning and cutter compensation.

Performance Requirement:

Given a list of standard word address codes match all word codes to their proper definition. Given 10 lines of a word address CNC program describe what function will be performed when read by a machine. Provided a simple part drawing chart the X and Y coordinates necessary to drive a tool around the periphery of the part.

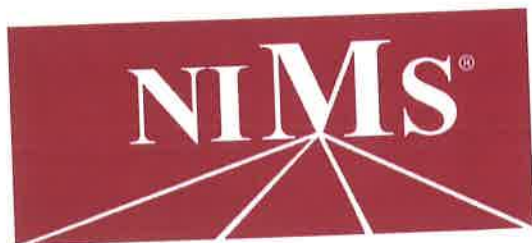
Reference: Student is not allowed to use the Machinery's Handbook

Duty Standard Cross Reference Table:

This table describes some of the activities that require this KSAO

Duty Area	Task	Activity
Job Planning	Process Planning	Identify needed word address codes
Job Execution	CNC Programming	Define tool path

Computer-Aided Manufacturing



Level I
Standards

Table of Contents

Acknowledgements	5
Introduction to Computer-Aided Manufacturing Standards – Level I	7
Duty Titles	9
Duty Area 1: Job Preparation	10
Duty Title 1.1: Process Planning – Milling	10
Duty Title 1.2: Process Planning – Turning	11
Duty Area 2: Modeling	12
Duty Title 2.1: 2D Sketching and 3D Modeling – Milling	12
Duty Title 2.2: 2D Sketching and 3D Modeling – Turning	13
Duty Area 3: Toolpath Generation	14
Duty Title 3.1: 2D - Milling	14
Duty Title 3.2: 2D - Turning	15
Duty Area 4: Documentation	16
Duty Title 4.1: Setups – Milling	16
Duty Title 4.2: Setups – Turning	17
Knowledge, Skills, Abilities & Other Characteristics (KSAOs)	19
KSAO Area 1: Written Oral Communication	20
KSAO Title 1.1: Reading	20
KSAO Title 1.2: Writing.....	21
KSAO Title 1.3: Speaking.....	22
KSAO Title 1.4: Listening.....	23
KSAO Area 2: Machining Mathematics	24
KSAO Title 2.1: Number Sense	24
KSAO Title 2.2: Arithmetic Operations	25
KSAO Title 2.3: Cartesian Coordinates	26
KSAO Title 2.4: Units and Conversions.....	27
KSAO Title 2.5: Geometry	28
KSAO Area 3: Decision Making and Problem Solving	29
KSAO Title 3.1: Applying Decision Rules	29
KSAO Title 3.2: Basic Problem Solving.....	30

KSAO Area 4: Social Skills and Personal Qualities	31
KSAO Title 4.1: Social Skills.....	31
KSAO Title 4.2 Personal Qualities	32
KSAO Area 5: Engineering Drawings and Sketches	33
KSAO Title 5.1: Print Interpretation	33
KSAO Title 5.2: Geometric Dimensioning and Tolerancing.....	34
KSAO Title 5.3: CAD Files	35
KSAO Area 6: Computer Operations.....	36
KSAO Title 6.1 Computer Hardware Components and Specifications	36
KSAO Title 6.2: Organizing and Managing Digital Information.....	37
KSAO Area 7: Technologies	38
KSAO Title 7.1: CNC Machines	38
KSAO Title 7.2: Workholding.....	39
KSAO Title 7.3: Cutting Tools	40
KSAO Title 7.4: Machine Codes	41
KSAO Title 7.5: Offsets and Compensation	42
Subject Matter Experts	43
NIMS Board of Directors	49

Acknowledgements

NIMS, Inc. extends a special thank you to Autodesk, Inc. for their partnership and sponsorship in the development of the Computer-Aided Manufacturing Standards. NIMS would like to recognize the following individuals and their teams for their ongoing support:

Carl Bass
President and CEO

Joe Bailey
Worldwide HSM CAM Sales Manager

Carl White
Senior Director, Manufacturing Strategy and Marketing

Al Whatmough
CAM Product Manager

Matt Pierce
Senior Manager

Tim Scanlon
Experience Innovation Lead, Office of the CTO - Manufacturing Products Group

Iven May
CAM Manager, Education Market Development

Chris Hall
Technical Marketing Manager

Tim Paul
Application Engineer

Introduction to Computer-Aided Manufacturing Standards – Level I

NIMS is pleased to present the first-ever industry-defined skills standards for computer-aided manufacturing (CAM). These standards will enhance education and training programs to meet 21st century demands for skilled CAM programmers, designers, and engineers. Skilled CAM programmers, designers and engineers with extensive education and training are in high demand to plan, manage, and control sophisticated and costly machines. This project will directly support the advancement of CAM training programs by developing industry standards for educating and training CAM programmers.

These standards have been developed by a national Technical Work Group and validated by over 100 subject matter experts in industry and education. Building on their input, these standards outline the basic requirements for a majority of entry-level CAM positions.

Overview

In June 2015, NIMS and Autodesk, Inc. launched an initiative to develop skills standards for CAM. Skills standards refer to the major duties, knowledge, and skills in which individuals must be proficient to meet performance requirements and expectations in the modern workplace. The national basis of these standards refers to the process followed in their development, namely that they be reviewed and reflect employer and employee opinions nationwide. The skills standards are intended to guide workforce development programs in the public and private sectors to build and sustain a globally competitive workforce. The standards also serve as the foundation for industry-recognized certifications offered by NIMS.

Duty Titles

Duty Area 1: Job Preparation

Duty Title 1.1: Process Planning – Milling

Duty:

Develop process plan to program part(s) requiring milling.

Performance Standard:

Given part definitions and equipment/tooling constraints, formulate a strategy to manufacture the parts. Process should include machine selection, tool list, workholding devices, machining operations and operational sequence. Process should identify part features that will be held and/or dimensionally controlled during machining to meet print specifications.

Formulate a process plan for Duty Title 3.1.

Evaluation Criteria:

Implementation of process plan for Duty Title 3.1.

Accuracy Level:

Sufficient strategy to program parts within full compliance of print specifications without adding or modifying process plans.

Assessment Equipment and Materials:

Workstation: Computer

Materials: N/A

Tooling: N/A

Measuring Instruments: N/A

References: Machinery's Handbook

Software: Word Processor, Spreadsheet

Duty Area 1: Job Preparation

Duty Title 1.2: Process Planning – Turning

Duty:

Develop process plans to program parts requiring turning.

Performance Standard:

Given part definitions and equipment/tooling constraints, formulate a strategy to manufacture the parts. Process should include machine selection, tool list, workholding devices, machining operations and operational sequence. Process should identify part features that will be held and/or dimensionally controlled during machining to meet print specifications.

Formulate a process plan for Duty Title 3.2.

Evaluation Criteria:

Implementation of process plans for Duty Title 3.2.

Accuracy Level:

Sufficient strategy to program parts within full compliance of print specifications without adding or modifying process plans.

Assessment Equipment and Materials:

Workstation: Computer

Materials: N/A

Tooling: N/A

Measuring Instruments: N/A

References: Machinery's Handbook

Software: Word Processor, Spreadsheet

Duty Area 2: Modeling

Duty Title 2.1: 2D Sketching and 3D Modeling – Milling

Duty:

Create and edit 2D model sketches.

Performance Standard:

1. Sketching
 - Given diagrams of 2D geometry and geometric constraints, create 2D sketches. Sketches should include lines, arcs, and circles.
 - Given 2D sketch data files and list of modification requirements, edit/modify the sketches.
2. Modeling
 - Given part definitions and instructions, create 3D models. Models should include islands, pockets, holes, fillets, chamfers, and patterns.
 - Given 3D model data files and list of modification requirements, edit/modify the models.

Evaluation Criteria:

Requirements checklist.

Accuracy Level:

Full compliance with requirements checklist.

Assessment Equipment and Materials:

Workstation: Computer

Materials: N/A

Tooling: Scientific Calculator

Measuring Instruments: N/A

References: Machinery's Handbook

Software: CAM

Duty Area 2: Modeling

Duty Title 2.2: 2D Sketching and 3D Modeling – Turning

Duty:

Create and edit 2D model sketches.

Performance Standard:

1. Sketching
 - Given diagrams of 2D geometry and geometric constraints, create 2D sketches. Sketch should include lines, arcs, and circles.
 - Given 2D sketch data files and list of modification requirements, edit/modify the sketches.
2. Modeling
 - Given part definitions and instructions, create 3D models. Models should include inside/outside diameters, shoulders, center hole(s), fillets, and chamfers
 - Given 3D model data files and list of modification requirements, edit/modify the models.

Evaluation Criteria:

Requirements checklist.

Accuracy Level:

Full compliance with requirements checklist.

Assessment Equipment and Materials:

Workstation: Computer

Materials: N/A

Tooling: Scientific Calculator

Measuring Instruments: N/A

References: Machinery's Handbook

Software: CAM

Duty Area 3: Toolpath Generation

Duty Title 3.1: 2D - Milling

Duty:

Generate 2D milling toolpath to 3D models.

Performance Standard:

Given 3D model data files and annotated drawing of models, generate appropriate toolpath and post process. Part designs require a minimum of two setups. Models should require toolpaths for facing, drilling, contouring, pocketing, slotting, and chamfering.

Evaluation Criteria:

- Requirements checklist.
- Machine Verification (Machine verification is an execution of the NC program on a machine tool. Setup and operation of machine tool must be completed independent of candidate).

Accuracy Level:

- Full compliance with requirements checklist
- Print specifications:
 - 125 ra max for all surfaces
 - .003" for profiles
 - .003" for flatness, perpendicularity, and parallelism
 - .005" for position
 - +/- .005" for all limit dimensions

Assessment Equipment and Materials:

Workstation: Computer

Materials: N/A

Tooling: Scientific or Machinist Calculator

Measuring Instruments: N/A

References: Machinery Handbook, Manufacturers Tooling Library/Catalog, Machine Tool Manual

Software: CAM

Duty Area 3: Toolpath Generation

Duty Title 3.2: 2D - Turning

Duty:

Generate 2D turning toolpath to geometric (solid) models.

Performance Standard:

Given 3D model data files and annotated drawing of models, generate appropriate toolpath and post process. Part designs require a single setup. Geometric models should require toolpaths for turning, facing, face grooving, outside/inside grooving, and outside/inside threading.

Evaluation Criteria:

- Requirements checklist.
- Machine Verification (Machine verification is an execution of the NC program on a machine tool. Setup and operation of machine tool must be completed independent of candidate).

Accuracy Level:

- Full compliance with requirements checklist
- Print specifications:
 - 125 ra max for all surfaces
 - .003" for profiles
 - .002" for concentricity or total runout
 - +/- .002" for all limit dimensions

Assessment Equipment and Materials:

Workstation: Computer

Materials: N/A

Tooling: Scientific or Machinist Calculator

Measuring Instruments: N/A

References: Machinery Handbook, Manufacturers Tooling Library/Catalog, Machine Tool

Manual

Software: CAM

Duty Area 4: Documentation

Duty Title 4.1: Setups – Milling

Duty:

Create milling machine operator documentation.

Performance Standard:

Given part definitions and process plans, create documentation required to setup and produce the parts. Documents should include tool lists, setup sheets, and instructions.

Create documentation for Duty Title 3.1.

Evaluation Criteria:

Implementation of documentation for Duty Title 3.1.

Accuracy Level:

Sufficient documentation to setup and produce parts within full compliance of print specifications without adding or modifying documents.

Assessment Equipment and Materials:

Workstation: Computer

Materials: N/A

Tooling: N/A

Measuring Instruments: N/A

References: Machinery's Handbook

Software: Word Processor, Spreadsheet, CAM

Duty Area 4: Documentation

Duty Title 4.2: Setups - Turning

Duty:

Create turning machine operator documentation.

Performance Standard:

Given part definitions and process plans, create documentation required to setup and produce the parts. Documents should include tool lists, setup sheets, and instructions.

Create documentation for Duty Title 3.2.

Evaluation Criteria:

Implementation of documentation for Duty Title 3.2.

Accuracy Level:

Sufficient documentation to setup and produce parts within full compliance of print specifications without adding or modifying documents.

Assessment Equipment and Materials:

Workstation: Computer

Materials: N/A

Tooling: N/A

Measuring Instruments: N/A

References: Machinery's Handbook

Software: Word Processor, Spreadsheet, CAM

Knowledge, Skills, Abilities & Other Characteristics (KSAOs)

KSAO Area 1: Written Oral Communication

KSAO Title 1.1: Reading

KSAO Definition:

Locates, understands, and interprets written technical and non-technical information in documents commonly found in the manufacturing industry. These documents contain short and simple sentences, paragraphs and passages, phrases, quantitative information, specialized vocabulary, graphs, charts, schedules, simple instructions, and multi-step directions. All documents are written in standard English.

Performance Requirement:

Given a specific duty to perform and the necessary written information contained on relevant documents and information sheets, locate and read the necessary information and use this information to plan, execute, and evaluate the duty and answer questions about the content or meaning of the written information.

KSAO Area 1: Written Oral Communication

KSAO Title 1.2: Writing

KSAO Definition:

Communicates technical and non-technical information, messages, and ideas in writing using standard English commonly found in the metalworking industry. This writing includes the completion of forms, information sheets, reports, group meeting materials, and short memos.

Performance Requirement:

Given a specific duty to perform and the necessary instructions, forms, and materials to complete the writing requirements for that duty, complete the writing requirement.

KSAO Area 1: Written Oral Communication

KSAO Title 1.3: Speaking

KSAO Definition:

Communicates technical and non-technical detailed information, messages, multi-step directions, and ideas through oral communication using standard English and related cues and communication aids in conversations, discussions, and group meetings. Understands and responds to listener feedback and asks questions when needed in two-way and group conversations.

Performance Requirement:

Given a specific duty to perform and the necessary instructions, written documents, and communication aids and materials to complete the speaking requirements for that duty, complete the speaking requirement.

KSAO Area 1: Written Oral Communication

KSAO Title 1.4: Listening

KSAO Definition:

Listens for, receives, interprets, and recalls specific details, ideas, and multi-step instructions in verbal presentations, conversations, discussions, and group meetings conducted in standard English and supported by written materials and other communication cues and aids. Uses active listening skills in comprehending simple technical and nontechnical verbal information.

Performance Requirement:

Given a specific duty to perform and the necessary written information contained on relevant documents and information sheets, listen for, comprehend, and incorporate oral information in the performance of the duty and answer questions about the content or meaning of the oral information.

KSAO Area 2: Machining Mathematics

KSAO Title 2.1: Number Sense

KSAO Definition:

- Identify positive and negative numbers, and explain the meaning of each.
- Identify whole, fractional, mixed, and decimal numbers.
- Demonstrate understanding of relative scale when comparing numbers.
- Convert numbers represented as fractions and mixed numbers to decimal numbers.
- Recognize decimal numbers that can be easily represented by common fractions and mixed numbers.

Performance Requirement:

Given a specific duty to perform requiring a sense of numbers, perform the required duty and answer questions about the use number sense.

KSAO Area 2: Machining Mathematics

KSAO Title 2.2: Arithmetic Operations

KSAO Definition:

- Apply the order of operations to multi-step arithmetic sequences.
 - Perform arithmetic operations of adding, multiplying, subtracting, and dividing of whole and decimal numbers using a calculator.
 - Perform arithmetic operations of adding, multiplying, subtracting, and dividing of simple whole, decimal, and fraction numbers mentally without a notepad or calculator.
 - Apply arithmetic operations of adding, multiplying, subtracting, and dividing to numbers represented as fractions.
 - Calculate percent of a whole and percent difference.
 - Estimate numerically-represented quantities such as speed, length, and diameter
- Rearrange an equation and solve for one unknown.

Performance Requirement:

Given a specific duty to perform requiring arithmetic operations, perform the required duty and answer questions about arithmetic operations.

KSAO Area 2: Machining Mathematics

KSAO Title 2.3: Cartesian Coordinates

KSAO Definition:

- Identify the three axes (X, Y, and Z) and associated planes.
- Understands “the right hand rule” for defining axes and identify positive and negative directions of Cartesian axes.
- Know the difference between absolute and incremental programming.

Performance Requirement:

Given a specific duty to perform requiring the use of Cartesian coordinates, perform the required duty and answer questions about Cartesian coordinates.

KSAO Area 2: Machining Mathematics

KSAO Title 2.4: Units and Conversions

KSAO Definition:

- Understands common units of measure for quantities such as length, angle, mass, weight, and speed.
- Understands linear and angular speed.
- Conversions between imperial and metric units of measure; degrees-minutes-seconds and decimal degrees; diameter and radius.

Performance Requirement:

Given a specific duty to perform requiring the use of units and conversions, perform the required duty and answer questions about units and conversions.

KSAO Area 2: Machining Mathematics

KSAO Title 2.5: Geometry

KSAO Definition:

Determine complementary and supplementary angles given an angle measurement and basic understanding of geometric concepts such as parallel, perpendicular, tangent, and symmetrical.

Performance Requirement:

Given a specific duty to perform requiring the use of geometry, perform the required duty and answer questions about geometry.

KSAO Area 3: Decision Making and Problem Solving

KSAO Title 3.1: Applying Decision Rules

KSAO Definition:

Can follow a set of instructions laid out in a sequence. Can interpret and follow "if....then...." instructions.

Performance Requirement:

Given a specific duty to perform requiring a checklist of sequential instructions, carry out the duty making appropriate entries on the checklist.

KSAO Area 3: Decision Making and Problem Solving

KSAO Title 3.2: Basic Problem Solving

KSAO Definition:

Can establish new responses to unexpected problems of a simple nature. Can formulate the new responses into a sequence of instructions or a set of "if ... then ..." rules.

Performance Requirement:

Given a specific duty to perform and being furnished with a checklist of sequential instructions, carry out the duty according to the checklist responding appropriately to problems. Formulate those responses into "if ... then ..." rules.

KSAO Area 4: Social Skills and Personal Qualities

KSAO Title 4.1: Social Skills

KSAO Definition:

Identify and demonstrate the appropriate social skills and related personal qualities in the performance of major duties requiring cooperative relations with supervisors, team leaders, and team members.

Performance Requirement:

Demonstrates understanding, friendliness, politeness, and empathy toward others including men and women, and with people from a variety of ethnic, social, and educational backgrounds. Works cooperatively with others and contributes to group efforts with ideas, suggestions, and positive feedback to group members. Demonstrates appropriate social and communication skills in resolving conflicts with supervisors, team leaders, and team members.

KSAO Area 4: Social Skills and Personal Qualities

KSAO Title 4.2 Personal Qualities

KSAO Definition:

Identify and demonstrate the appropriate personal qualities in performing major job duties and maintaining positive employment relations.

Performance Requirement:

Recognizes and demonstrates appropriate codes of conduct and values in the workplace and demonstrates honesty and integrity in exhibiting appropriate workplace behaviors. Assumes responsibility and demonstrates strong work ethic by exerting effort and perseverance in doing work tasks according to high standards. Maintains high standards of attendance, punctuality, and involvement in all major work tasks.

KSAO Area 5: Engineering Drawings and Sketches

KSAO Title 5.1: Print Interpretation

KSAO Definition:

- Interpret and understand various line types including geometry lines, hidden lines, dimension lines, center lines, and section lines.
- Spatially visualize a 3D part by referencing 2D drawing views.
- Maintain a basic understanding of ISO and ANSI standard drawing conventions for orthographic projections.
- Understand the differences between third-angle and first-angle orthographic projections, and where orthographic projection views are placed on the drawing sheet.
- Interpret and understand section views and detail views.
- Maintain a basic understanding of ISO and ANSI standard drawing conventions.
- Interpret drawing notes including material type, hardware, surface treatments, surface finish, post-machining processes, etc.

Performance Requirement:

Given a specific duty to perform requiring print interpretation, perform the required duty and answer questions about the use print interpretation.

KSAO Area 5: Engineering Drawings and Sketches

KSAO Title 5.2: Geometric Dimensioning and Tolerancing

KSAO Definition:

Familiarity with Geometric Dimensioning and Tolerancing concepts and symbols as defined by the most commonly recognized version of ASME Y14.5. This includes: datum reference frame (DRF), degrees of freedom (DOF), feature control frame, geometric control symbols, geometric tolerancing categories, geometric tolerancing characteristics, geometric tolerancing zone shapes, and symbols associated with feature control frames.

Performance Requirement:

Given a specific duty to perform requiring understanding of Geometrical Dimensioning and Tolerancing, perform the required duty and answer questions about Geometrical Dimensioning and Tolerancing.

KSAO Area 5: Engineering Drawings and Sketches

KSAO Title 5.3: CAD Files

KSAO Definition:

- Understands various file types used to represent 2D geometry such as EPS and DXF.
- Understands various file types used to represent 3D model data such as STEP, IGES, STL, Parasolid x_t and x_b, SAT and CAD software-specific file types.
- Understands universally-accepted file types in both CAD and CAM software programs for import and export.
- Understand differences between solid, surface, wireframe, and mesh geometry definition types.
- Understand Download Numerical Code (DNC) system.
- Identify part geometry features such as holes, threads, fillets, chamfers, extrusions, lofts, slots, revolutions and patterns.

Performance Requirement:

Given a specific duty to perform requiring understanding of CAD files, perform the required duty and answer questions about CAD files.

KSAO Area 6: Computer Operations

KSAO Title 6.1 Computer Hardware Components and Specifications

KSAO Definition:

- Identify major computer components such as the graphics processing unit, CPU, RAM, and hard disk drive.
- Describe the discrete functions and interrelatedness of major computer components such as the graphics processing unit, CPU, RAM, and hard disk drive, as they pertain to system performance.
- Demonstrate awareness of and basic understanding of current computer technologies, specifications and quantities, such as clock speed (GHz), cores, 32-bit and 64-bit software, and system architecture.
- Identify and interpret software system requirements.

Performance Requirement:

Given a specific duty to perform requiring understanding of hardware components and specification, perform the required duty and answer questions about hardware components and specification.

KSAO Area 6: Computer Operations

KSAO Title 6.2: Organizing and Managing Digital Information

KSAO Definition:

- Understands file naming conventions standards according to industry and workplace.
- Perform cut, copy, and paste functions.
- Utilize digital data storage methods including local, network, and cloud storage.
- Organize electronic files, folders and directory structures, maintaining awareness of both physical and organizational locations of the data.

Performance Requirement:

Given a specific duty to perform requiring organizing and managing digital information, perform the required duty and answer questions about organizing and managing digital information.

KSAO Area 7: Technologies

KSAO Title 7.1: CNC Machines

KSAO Definition:

- Identify and understand types, configurations and applications of various computer numerically controlled cutting equipment, such as vertical and horizontal mills, lathes, EDM, plasma cutters, waterjets, and laser cutters.
- Identify major machine components such as spindles, tables, pallet changers, turrets, and tool changers.
- Identify major machine accessories and options such as chip conveyors, rotary tables and indexers, pallet changers, and live tooling.
- Identify and name the axes of motion for three-axis mills and routers, and two-axis lathes.
- Understand machine kinematics.
- Identify common machine controls such as Siemens, Haas, Fanuc, etc.
- Machine and control capabilities and limitations.

Performance Requirement:

Given a specific duty to perform requiring knowledge of machine types, perform the required duty and answer questions about machine types.

KSAO Area 7: Technologies

KSAO Title 7.2: Workholding

KSAO Definition:

Understands application and operation of fundamental commercially-available workholding devices such as: vises, chucks, collets, step blocks, and toe clamps.

Performance Requirement:

Given a specific duty to perform requiring workholding, perform the required duty and answer questions about workholding.

KSAO Area 7: Technologies

KSAO Title 7.3: Cutting Tools

KSAO Definition:

Understands cutter feeds, speeds, and chip load for efficient programming for both roughing and finishing on various materials. Research tooling technology for efficient machining and select appropriate cutters. Apply manufacturer's recommended parameters and specifications to machining applications.

Performance Requirement:

Given a specific duty to perform requiring cutting tools, perform the required duty and answer questions about cutting tools.

KSAO Area 7: Technologies

KSAO Title 7.4: Machine Codes

KSAO Definition:

- Understanding of common preparatory functions (G-Codes) including codes used to command:
 - Work offset selection
 - Unit selection
 - Absolute and incremental positioning
 - Rapid motion
 - Linear and circular interpolation
 - Modal and non-modal commands
 - Cutter compensation
 - Drilling, tapping, and boring canned cycles (mill and lathe)
 - Lathe roughing and finishing canned cycles
- Understanding of common miscellaneous functions (M-Codes) including codes used to command:
 - Spindle
 - Coolant
 - Program end
 - Optional and force stops
 - Tool change
- Understanding of various canned cycle parameters such as peck amount and R plane selection.

Performance Requirement:

Given a specific duty to perform requiring machine codes, perform the required duty and answer questions about machine codes.

KSAO Area 7: Technologies

KSAO Title 7.5: Offsets and Compensation

KSAO Definition:

Understanding of work and tool length offsets and compensation adjustments of bearing bores, circular bosses, and other critical geometry.

Performance Requirement:

Given a specific duty to perform requiring offsets and compensation, perform the required duty and answer questions about offsets and compensation.

Subject Matter Experts

These skills standards were created by over 120 experts in the field. Below are the following individuals who approved their names to be published in this standard.

Please note: An asterisks denotes a Technical Work Group member.

George Abraham*
San Francisco, California

Dann Adkins
Ivy Tech Community College
Indianapolis, Indiana

Bryan Alguire
Mohawk Valley Community College
Utica, New York

Mike Appio*
De Anza College
Cupertino, California

Hector Arteaga
University of Texas RGV
Edinburg, Texas

Bob Bronkar
C-TEC
Newark, Ohio

Robert Burns
KY TECH Harrison County Area
Technology Center
Cynthiana, Kentucky

Keith Butzgy
CNC Software
Hartford, Connecticut

Daniel Coffin
Asnuntuck Community College
Westfield, Massachusetts

David Black*
Clark Magnet High School
Glendale, California

Mark Blackstock
The Colony, Texas

Mark Bosworth
Southwestern Illinois College
Granite City, Illinois

Lawrence Bowyer
Brooks Machine and Design Inc.
Zebulon, North Carolina

Robert Bressani
Asnuntuck Community College
Enfield, Connecticut

John Cowan
3Dallas Printing
Richardson, Texas

Jerry Crichfield
Boston Scientific
Indiana

Al DePoalo
BobCAD CAM Inc
Clearwater, Florida

Gary Dilbeck
Automated Solutions Inc.
Asheboro, North Carolina

Ed Doherty
Suncoast Technical College
Sarasota, Florida

Diane Dostie
Central Maine Community College
Auburn, Maine

Daniel Eads
Boston Scientific
Spencer, Indiana

Curtis Elliott
East Central College
Union, Missouri

Juan Ferguson
Custom Crafter
Chicago, Illinois

Brian Fleming
Richland College
Richardson, Texas

Jason Fogleman
Cumberland Perry AVTS
Mechanicsburg, Pennsylvania

Jeff Foster*
Delcam
Las Vegas, Nevada

Corey Freda
Mountain Machine Works
Auburn, Maine

Andrew Geppert
Cape Fear Community College
Wilmington, North Carolina

Gary Giordano
Arkansas State University Mid-South
West Memphis, Arkansas

Dean Giovannetti*
NASA Applied Mfg. Division
California

Gene Granata*
CGTech
Irvine, California

Chris Hall*
Autodesk
Novi, Michigan

Larry Hartman
Front Range Community College
Longmont, Colorado

F. Aubrin Heinrichs
Gallatin College Montana State University
Bozeman, Montana

Kenneth Heins
KLH Industries Inc.
Germantown, Wisconsin

Brandon Hensley
Western Piedmont Community College
Morganton, North Carolina

Garry Hensley
Western Piedmont Community College
Morgantown, North Carolina

Denis Hernandez
Upper Bucks County Technical School
Sellersville, Pennsylvania

Gary Hole
HNI, Hon & AllSteet
Washington, Iowa

Tim Holt
Bevill State Community College
Jasper, Alabama

Rick Huddleston
Tulsa Tech
Tulsa, Oklahoma

Richard Hyre
M&H Supply
Fort Worth, Texas

Mason Ide
Idea Development Expeditors
Gorham, Maine

Damion Johnson
Johnson CNC Consulting
Cocoa, Florida

Rod Jones*
DMG/MORI Seiki USA
Hoffman Estates, Illinois

Brian Keever
Shoreline Community College
Seattle, Washington

Gene M. Keyes
Schoolcraft College
Livonia, Michigan

Robert Kornienko*
NASA
Moffett Field, California

Gregory Kuhn
Ivy Tech Community College-Central
Indiana Region, Indianapolis Campus
Indianapolis, Indiana

Jerald Logan
Green Country Technology Center
Okmulgee, Oklahoma

Matthew Manton
camInstructor
Kitchener, Ontario

Keith Martin
Bristol Plymouth Regional Technical High
East Taunton, Massachusetts

Iven May*
Autodesk
Gig Harbor, Washington

Paul Mayer
Dallas County Manufactures Association
Garland, Texas

Calvin Mayo
Pitt Community College
Winterville, North Carolina

Mark McCollough*
Fresno City College
Fresno, California

William Merchantz
Elk Grove High School
Elk Grove Village, Illinois

Luis Meza
Dona Ana Community College
Las Cruces, New Mexico

Terry Miller
Jefferson County Public Schools
Louisville, Kentucky

Jeffrey Montgomery
North Central Michigan College
Petoskey, Michigan

Tad Montgomery
Calhoun Community College
Decatur, Alabama

Bryant Morgan*
Sandia National Laboratory
Livermore, California

John Nelson*
HAAS Automation
Oxnard, California

Tim Paul*
Autodesk
San Francisco, California

Scott Paulk
Alexandria Industries
Texas

Wallace Pelton
Texas State Technical College
Waco, Texas

Bill Perfetti
ITT / Goulds Pumps
Seneca Falls, New York

James Preston
Lincoln County Area Technology Center
Stanford, Kentucky

Mike Randolph
Park Engineering
Buena Park, California

Jason Roth
Ivy Tech Community College, Central
Indiana
Indianapolis, Indiana

Ed Salazar
HFO Dallas
Richardson, Texas

Todd Sanders
Danville Community College
Danville, Virginia

Boris Schatalow*
Google
Mountain View, California

Derek Seeke
Guilford Technical Community College
Jamestown, North Carolina

Leo Slatin
Oakland Schools Technical Campus SE
Royal Oak, Michigan

Jacob Statz
Madison Area Technical College
Madison, Wisconsin

Jeff Tiedeken*
Monkey Like Shiny
Berkeley, California

Bruce Tisdale
Mountain Machine Works
Auburn, Maine

Craig vanHamersveld
Campat Machine Tool, Inc.
Plano, Texas

Rolland Wakefield
Lincoln College of Technology
Indianapolis, Indiana

Jimmy Wakeford
Barefoot CNC
Morgantown, North Carolina

Jeff Wallace*
DMG/MORI Seiki USA
Chicago, Illinois

Ricky Washburn
Huntsville Center for Technology
Huntsville, Alabama

Gary Waszcyszak
USMC
Camp Lejeune, North Carolina

Ron Way
El Camino College
Torrance, California

Al Whatmough*
Autodesk
San Francisco, California

Thomas Whittingham
Clark County Skills Center
Vancouver, Washington

Larry Williams
Colorado Dept. of Corrections
Buena Vista, Colorado

Chris Williams
Industrial Tool Die And Engineering
Tucson, Arizona

Bryce Willing
Regal
Plano, Texas

Justin Wright
State Fair Community College
Sedalia, Missouri

NIMS Board of Directors

Kimberly Arrigoni
Haberman Machine, Inc.
St. Paul, Minnesota

John Belzer
TCI Precision Metals
Gardena, California

Mark Brownhill
FANUC America Corporation
Earlysville, Virginia

Greg Chambers*
Chairman of NIMS Board
Oberg Industries, Inc.
Freeport, Pennsylvania

Brian Flores
Sandvik Coromant
Canton, Ohio

Miles Free
Precision Machined Products Association
(PMPA)
Brecksville, Ohio

Paul Huber*
COMEX
Bridgeport, Connecticut

Greg Jones
AMT - The Association for Manufacturing
Technology
McLean, Virginia

Roderick Jones
DMG / Mori Seiki University
Hoffman Estates, Illinois

Mark Lashinske*
Modern Industries, Inc.
Phoenix, Arizona

Bob Laudeman

Harry Moser
Reshoring Initiative
Kildeer, Illinois

Patrick Osborne
Technology and Manufacturing
Association (TMA)
Park Ridge, Illinois

Mario Reyna
South Texas College
McAllen, Texas

Dave Sansone*
Precision Metalforming Association (PMA)
Independence, Ohio

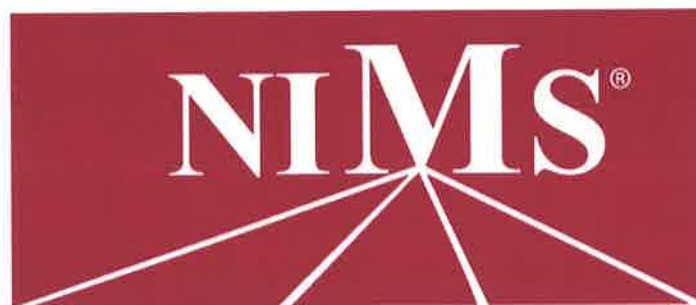
Bob Skodzinsky*
Haas Automation HTEC Network
Sarasota, Florida

Roy Sweatman*
Southern Manufacturing Technologies,
Inc.
Tampa, Florida

Dave Tilstone
National Tooling & Machining Association
(NTMA)
Cleveland, Ohio

Sherrie Williams
The Boeing Company
Auburn, Washington

*Denotes Executive Committee Member



NIMS, Inc.

10565 Fairfax Boulevard

Suite 10

Fairfax, Virginia 22030

www.nimsready.org



See our Sales Flyers!

Submitted »

Streamwood, South Elgin high schools earn national metalworking accreditation

Elgin Area School District U-46

Updated
1/4/2016 11:47 AM



Elgin Area School District U-46's precision manufacturing classes offers students, such as South Elgin High School junior Dylan Rasmussen, hands-on training in precision measurement and learning how to operate lathe, milling and grinding machines. (Courtesy of U-46)

Show photos

The precision manufacturing programs at Streamwood and South Elgin high schools earned national accreditation for the exceptional metalwork training offered to students.

Such high-level training and accreditation ensures students are better prepared to succeed in the workforce, according to the National Institute of Metalworking Skills, the group that recently awarded the programs with their seal of approval.

"The staff and faculty of both schools, and of School District U-46, have met NIMS standards and will continue to set the bar for exceptional metalworking training," said Catherine Ross, NIMS Director of Accreditation. "In earning accreditation, both high schools demonstrate a continued commitment to providing industry-level training within the state of Illinois and for the greater U.S. manufacturing industry."

It is the first time that the programs have been accredited by NIMS, which offers the only nationally-recognized accreditation for excellence in metalworking training based on industry standards. The two U-46 schools are only the fourth and fifth schools in Illinois whose machining programs have been recognized by NIMS. Nationally, only about 75 programs have been accredited.

Earlier this fall, NIMS inspectors interviewed faculty and students as well as local employers who hire students who have completed the precision manufacturing programs. NIMS also inspected metalworking facilities at the schools and issued ratings in areas like administrative support, program purpose, equipment and instructional staff.

"As a district, we embrace the concept of program improvement through evaluation," said Kinasha Brown, U-46 Coordinator of Career and Technical Education. "This allows us to offer the Precision Manufacturing students learning and preparatory experiences that result in true career readiness."

By working with NIMS, Elgin Area School District U-46 ensures that its programs are meeting national standards, and the ongoing relationship will help the district make sure its programming and support remain current with industry innovations, said Ron Raglin, U-46 Assistant Superintendent for Education Support Programs and Alignment.

"Ultimately, the winner is School District U-46 students and their families," Raglin said.

In the district's precision manufacturing classes, students get hands-on training in precision measurement and learn how to operate lathe, milling and grinding machines. There is an emphasis on designing a production process and CNC education, the computer numerical control systems that are prevalent in today's clean, modern world of manufacturing.

"Manufacturing is no longer a career where you just stand in front of a machine," said Dr. Lars Aldinger, the executive vice president of production and logistics for Wittenstein, a German-based precision manufacturer whose North American headquarters in Bartlett has offered internships and a scholarship program to U-46 students.

The courses challenge students to use a variety of skills. South Elgin High School teacher Russ Bartz said his manufacturing students must maintain a weekly journal of what they have learned. It promotes writing ability and discipline -- important life skills. Bartz tells his students it is how they "earn their paycheck."

At Streamwood, teacher Matt Erbach said his lesson for figuring out the correct depth of a countersink is right out of trigonometry class.

"But the fact that it is applied to a real project they are producing helps students to engage with what could otherwise be a pretty boring piece of math," Erbach said.

U-46 students can earn college credit and also earn individual certification through NIMS.

The school program accreditation is based on NIMS national level machining skills standards with an emphasis on computer controlled milling and turning operations; job planning, bench work, layout and measurement, materials and safety. The designation is valid for a five-year period.

Two U46 high schools get metalworking accreditation

By **Geoff Ziezwlewicz**
Elgin Courier-News

SHARE THIS



Two U46 high schools received accreditation for metalwork training programs

DECEMBER 1, 2015, 3:46 PM

Two School District U46 high schools recently received national accreditation for the metalwork training offered to students, two of only a handful of Illinois programs to receive such a designation, according to a district release.

The precision manufacturing programs at Streamwood and South Elgin high schools recently received the distinction from the National Institute for Metalworking Skills, which district officials say will help ensure students are better prepared to succeed in the workforce.

This signifies the first time either school program has received five-year accreditation from the institute, an organization that offers the only nationally recognized accreditation for metalworking training based on industry standards, according to the district.

Streamwood and South Elgin are just the fourth and fifth schools in Illinois to receive such recognition by the institute, according to the district.

"The staff and faculty of both schools, and of School District U46, have met NIMS standards and will continue to set the bar for exceptional metalworking training," said Catherine Ross, NIMS's accreditation director.

The district's ongoing relationship with NIMS will ensure that such programs continue to meet national standards, preparing students for industry jobs in the future, according to the release.

Precision manufacturing classes give students hands on training in everything from precision measurement to learning how to operate lathe, milling and grinding machines, according to the district.

An emphasis is also placed on production process design and the computerized side of "today's clean, modern world of manufacturing," the release states.

Such courses also challenge students to develop their writing abilities and self discipline, according to the release.

"Manufacturing is no longer a career where you just stand in front of a machine," Dr. Lars Aldinger, of the Germany-based precision manufacturer Wittenstein, said in the release.

Wittenstein's North American headquarters in Bartlett has offered internships and scholarships to U46 students, the release states.

NIMS was formed in 1995 by metalworking trade associations to develop and maintain a globally competitive workforce, according to the group's website.

Subscribe to get *Gear Technology* delivered to your in-box. Yes please!

HOME ADVERTISE SUBSCRIBE CONTACT US



CNC Hobbers, Shapers, Shavers, Gear Grinders and more!



TOPICS CURRENT ISSUE GT LIBRARY BUYERS GUIDE NEWSLETTER PRODUCT ALERTS BLOG NEWS & EVENTS POWERTRANSMISSION.COM

Subscribe Fast - N - Easy in LinkedIn Join us on Twitter Follow us on Facebook Like us gear TECHNOLOGY TV

Search by Author here search

NIMS Announces Two New Accreditations of High School Precision Manufacturing Programs

December 10, 2015

NIMS is pleased to announce accreditation of the Precision Manufacturing Programs at South Elgin High School and Streamwood High School. Officially accredited as of November 11, 2015, the staff and faculty of both schools, and of School District U-46, have met NIMS standards and will continue to set the bar for exceptional metalworking training.



NIMS recently accredited two new high school metalworking programs at South Elgin High School and Streamwood High School

This marks the first time that each program has secured NIMS accreditation; the only national benchmark for excellence in metalworking training as based on national industry-written, industry-approved standards. In doing so, both high schools demonstrate a continued commitment to providing industry-level training within the state of Illinois and for the greater US Manufacturing Industry.

To complete the accreditation audit, an on-site evaluation took place in October and was conducted by Lead Evaluator Terry Babb (Apex Tool & Mfg., Inc.) and Education Rep Juan Del Castillo (Jane Addams Resource Corporation).

The visit included facility inspections of both metalworking shops, as well as interviews with students, instructors, administrators, and local employers. Following these events, the evaluation team gathered enough evidence to recommend accreditation and issued above-average ratings in most areas of evaluation including program purpose, facilities, equipment/tooling/measuring devices, administration, instructional staff, and advisory committee support.

This accreditation is based on NIMS National Level I Machining Skills Standards with an emphasis on CNC Milling Operations; CNC Turning Operations; Job Planning, Benchwork, and Layout; and Measurement, Materials and Safety

Establishing this industry benchmark secures accreditation of each program for the next five years.

For more information:

National Institute for Metalworking Skills, Inc.
Address: 10565 Fairfax Boulevard, Suite 10
Fairfax, VA 22030
Phone: (703) 352-4971
Fax: (703) 352-4991
URL: www.nims-skills.org/web/nims/home

ADVERTISEMENT

PLACE YOUR AD HERE

Advertisement for gear technology magazine featuring a stack of magazines and a red button that says "FREE SUBSCRIPTION CLICK HERE".

RECENT ARTICLES



The Evolution of Gear Chamfering
September/October 2018

Deburring - The Underestimated Task
September/October 2018

Everything-Friendly Lubricants
September/October 2018

FIND MORE ARTICLES ON

Precision Manufacturing Course Planner

	9th Sem 1	9th Sem 2	10th Sem 1	10th Sem 2	11th Sem 1	11th Sem 2	12th Sem 1	12th Sem 2
Language Arts	Fresh English or Fresh English (H)	Fresh English or Fresh English (H)	Soph English or Soph English (H)	Soph English English (H)	Junior English or AP Language and Composition	Junior English or AP Language and Composition	Senior English or AP Literature and Composition	Senior English or AP Literature and Composition
Math	Algebra 1/2 Geometry (H) Algebra 3/4 (H)	Algebra 1/2 Geometry (H) Algebra 3/4 (H)	Geometry (H) Algebra 3/4 (H) Trig/Precalc (H)	Geometry (H) Algebra 3/4 (H) Trig/Precalc (H)	Algebra 3/4 (H) Trig/Precalc (H) Finite AP Calc or Stats	Algebra 3/4 (H) Trig/Precalc (H) Finite AP Calc or Stats		
Science	Biology (H)	Biology (H)	IPS Chemistry (H)	IPS Chemistry (H)				
Social Studies			*US History (AP) *Civics/Econ (AP)	*US History (AP) *Civics/Econ (AP)	*US History (AP) *Civics/Econ (AP)	*US History (AP) *Civics/Econ (AP)	*US History (AP) *Civics/Econ (AP)	*US History (AP) *Civics/Econ (AP)
PE/Health	PE	PE	PE/Health	PE/Health	PE	PE	PE	PE
Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch
Elective			Production Technology	Production Technology	Precision Manufacturing	Precision Manufacturing	Advanced Precision Manufacturing	Advanced Precision Manufacturing
Elective					Precision Manufacturing	Precision Manufacturing	Advanced Precision Manufacturing	Advanced Precision Manufacturing
Elective								
Elective								
Elective								

(H) Honors Course Option, (AP) Advanced Placement Course Option

The school day is eight periods in length

White squares are graduation requirements, green squares are elective options for college/career planning. *US History and Civics/Econ can be taken at any time in 10th, 11th, or 12 grade

District U-46 12th Grade Course Selection Sheet for 2019/2020 School Year

Name _____ ID# _____ Date of Birth _____

Core Curriculum: Select 1 from each category as needed for graduation requirements.

Select up to 4 electives. Prioritize your selections from 1 to 4. (Additional courses on back of this page.)

LANGUAGE ARTS

_____ Freshman English 1-2 LA100GE1/2
 _____ Sophomore English 1-2 LA200GE1/2
 _____ Junior English 1-2 LA300GE1/2
 _____ Senior English 1-2 LA400GE1/2
 _____ AP English Lit & Comp LA470AP1/2

MATH

_____ Algebra 1 MA100GE1/2
 _____ Geometry MA200GE1/2
 _____ Honors Geometry MA220HN1/2
 _____ Algebra 2 MA300GE1/2
 _____ Honors Algebra 2 MA320HN1/2
 _____ Pre-Calculus MA500GE1/2
 _____ Honors Pre-Calculus MA520HN1/2
 _____ AP Calculus AB MA570AP1/2
 _____ AP Calculus BC MA575AP1/2
 _____ AP Statistics MA670AP1/2
 _____ Finite Mathematics MA700GE1/2
 _____ AP Computer Science A MA740AP1/2
 _____ AP Computer Science Principle: MA750AP1/2

PHYSICAL EDUCATION & HEALTH

_____ Functional Fitness: Mod A PE130GE3
 _____ Functional Fitness: Mod B PE135GE3
 _____ Strength & Performance: Mod PE140GE3
 _____ Strength & Performance: Mod I PE145GE3
 _____ Team Sport Officiating & Coach PE150GE3
 _____ Mod A
 _____ Team Sport Officiating & Coach PE155GE3
 _____ Mod B
 _____ Walking for Wellness: Mod A PE160GE3
 _____ Walking for Wellness: Mod B PE165GE3
 _____ Lifeguard Certification & Leader PE110GE3
 _____ Sophomore PE PE200GE3
 _____ JR/SR PE Dance PE310GE1/2
 _____ JR/SR PE Individ/Dual Sport PE320GE1/2
 _____ JR/SR PE Personal Fitness PE330GE1/2
 _____ JR/SR PE Cond & Weights PE340GE1/2
 _____ JR/SR PE Team Sports PE350GE1/2
 _____ Intro to Leadership in PE PE170GE3
 _____ Advanced Leadership in PE PE175GE3
 _____ SR Leadership Practicum in PE PE430GE3
 _____ Health Education HE010GE3

SCIENCE

_____ Biology 1-2 SC000GE1/2
 _____ Honors Biology 1-2 SC050HN1/2
 _____ AP Biology SC070AP1/2
 _____ Chemistry 1-2 SC100GE1/2
 _____ Honors Chemistry 1-2 SC100HN1/2
 _____ AP Chemistry SC170AP1/2
 _____ Geology 1-2 SC200GE1/2
 _____ Integrated Physical Science SC300GE1/2
 _____ Physics 1-2 SC400GE1/2

_____ Honors Physics 1-2 SC400HN1/2
 _____ AP Physics C SC470AP1/2
 _____ AP Physics 1 SC420AP1/2
 _____ Environ Science 1-2 SC500GE1/2
 _____ AP Environ Science SC570AP1/2

SOCIAL STUDIES

_____ United States History SS200GE1/2
 _____ AP United States History SS270AP1/2
 _____ Civics SS300GE3
 _____ AP Govt & Politics: US SS370AP3
 _____ Economics SS400GE3
 _____ AP Macro Economics SS470AP3

ART

_____ Discovery Draw & Painting AR000GE3
 _____ Discovery Photography AR010GE3
 _____ Discovery Sculpture AR020GE3
 _____ Ceramics 1-2 AR100GE1/2
 _____ Ceramics 3-4 AR130GE1/2
 _____ Ceramics 5-6 AR150GE1/2
 _____ Drawing 1-2 AR200GE1/2
 _____ Drawing 3-4 AR230GE1/2
 _____ Drawing 5-6 AR250GE1/2
 _____ Jewelry 1-2 AR300GE1/2
 _____ Jewelry 3-4 AR330GE1/2
 _____ Jewelry 5-6 AR350GE1/2
 _____ Painting 1-2 AR400GE1/2
 _____ Painting 3-4 AR430GE1/2
 _____ Painting 5-6 AR450GE1/2
 _____ Photography 1-2 AR500GE1/2
 _____ Photography 3-4 AR530GE1/2
 _____ Photography 5-6 AR550GE1/2
 _____ Sculpture 1-2 AR600GE1/2
 _____ Sculpture 3-4 AR630GE1/2
 _____ Sculpture 5-6 AR650GE1/2
 _____ Cartoon/Animation 1-2 AR700GE1/2
 _____ Cartoon/Animation 3-4 AR730GE1/2
 _____ Fine Arts Studio AR800GE1/2
 _____ AP Art History GE170AP1/2

AVID

_____ Senior AVID AV400GE1/2

BUSINESS EDUCATION

_____ Computer Apps BU100GE3
 _____ Adv. Computer Apps BU200GE3
 _____ Multimedia & Design Pr BU300GE3
 _____ Marketing BU500GE3
 _____ Mgmt. & Entrepreneur BU510GE3
 _____ Entrepreneurial Intern BU520GE3
 _____ Web & Media Design BU600GE3
 _____ Adv. Web & Media Design BU700GE3
 _____ Accounting BU000GE1/2
 _____ College Accounting BU010GE1/2

_____ Cooperative Internship 1-2 (Class Year 1) CE800GE1/2
 _____ Cooperative Internship 1-2 (Job) CE810GE1/2

DRAMA

_____ The Theatre Experience EN610GE3
 _____ Actor's Workshop EN630GE3
 _____ Advanced Theatre Production EN620GE1/2

DRIVER EDUCATION

_____ Driver Education (Class) DE010GE3

FAMILY & CONSUMER SCIENCE

_____ Childhood Development FC100GE3
 _____ Fashion/Apparel Marketing & Merchandise FC230GE3
 _____ Childhood Education FC110GE1/2
 _____ Adv. Childhood Education FC120GE1/2
 _____ Fashion/Apparel Constr & Textile 1 FC200GE1/2
 _____ Fashion/Apparel Constr & Textile 2 FC210GE1/2
 _____ Intro to Culinary Arts FC300GE1/2
 _____ Culinary Arts FC310GE1/2
 _____ Advanced Culinary Arts FC320GE1/2
 _____ Culinary Arts & Restaurant Management (1 Hr) FC330GE1/2
 _____ Culinary Arts & Restaurant Management (2 Hr) FC340GE1/2
 _____ Education Intern (2 Hr) FC400GE1/2
 _____ Cooperative Internship 1-2 (Class Year 1) CE800GE1/2
 _____ Cooperative Internship 1-2 (Job) CE810GE1/2

HEALTH CARE SCIENCE

_____ Foundations of Health Care Science HE114GE3
 _____ Fundamentals of Human Anatomy HE124GE3
 _____ Adv. Health Care Science HE214GE1/2
 _____ CNA (Certified Nursing Asst.) HE234HN1/2
 _____ Principles of Biomedical Science (H), PLTW HE514HN1/2
 _____ Human Body Systems (H), PLTW HE515HN1/2
 _____ Medical Interventions (MI), (H) PLTW HE616HN1/2
 _____ Health Care Science Internship (Class) CE716GE1/2
 _____ Health Care Science Internship (Job) CE726GE1/2

NOTE: Classes on this selection sheet will be offered if they meet minimum enrollment numbers. It is imperative that students request in preferred order their 1st, 2nd, 3rd, and 4th choice of alternative/additional elective courses.

Name _____ ID# _____ Date of Birth _____

District U-46 12th Grade Course Selection Sheet for 2019/2020 School Year

Select up to 4 electives. Prioritize your selections from 1 to 4. (Additional courses on back of this page.)

LANGUAGE ARTS

_____	Speech Communications	LA580GE3
_____	Argumentation	LA590GE3
_____	Leadership in Action	LA650GE1/2
_____	21st Century Media	LA640GE1/2
_____	Senior Literacy Lab	RE425GE1/2
_____	Creative Writing	LA500GE1/2
_____	Production & Publication I	LA560GE1/2
_____	Production & Publication II	LA570GE1/2

MATH *Pending board approval

_____	Computer Programming J 1-2	MA720GE1/2
_____	Transition to College Algebra*	MA550GE1/2
_____	Transition to Quantitative Literacy and Statistics*	MA560GE1/2
_____	Transition to Technical Math*	MA540GE1/2

MUSIC

_____	Madrival Singers	MU050GE1/2
_____	Treble Choir	MU100GE1/2
_____	Chamber Choir	MU110GE1/2
_____	Concert Choir Mixed	MU120GE1/2
_____	Mellodears	MU130GE1/2
_____	Mixed Chorus	MU140GE1/2
_____	Concert Band	MU200GE1/2
_____	Symphonic Band	MU210GE1/2
_____	Wind Ensemble	MU220GE1/2
_____	Jazz Band	MU230GE1/2
_____	Varsity Band	MU240GE1/2
_____	Chamber Orchestra	MU300GE1/2
_____	Concert Orchestra	MU310GE1/2
_____	Symphony Orchestra-Philharmonic	MU330GE1/2
_____	Music Theory & Appreciation	MU400GE1/2

SOCIAL STUDIES

_____	International Relations	SS050GE3
_____	AP Micro Economics	SS475AP3
_____	AP Comparative Government & Politics	SS310AP3
_____	Intro to Law I	SS500GE3
_____	Law II	SS510GE3
_____	Intro to Psychology	SS600GE3
_____	Sociology	SS620GE3
_____	World History	SS000GE1/2
_____	AP World History	SS070AP1/2
_____	World Geography	SS100GE1/2
_____	AP Psychology	SS670AP1/2
_____	AP European History	SS770AP1/2
_____	AP Human Geography	SS970AP1/2

STUDY HALL/LUNCH

_____	Lunch (9-12)	SL000GE1/2
_____	Study Center (9-12)	SU000GE1/2

TECHNOLOGY EDUCATION

_____	Automotive Technology	TE114GE1/2
_____	Advanced Auto Tech	TE134GE1/2
_____	Auto Service (2hrs.)	TE154GE1/2
_____	Production Technology (SEHS/SHS only)	TE160GE1/2
_____	Precision Manufacturing (2hrs.)(SEHS/SHS only)	TE524GE1/2
_____	Adv. Precision Manufacturing (2hrs.)(SEHS/SHS only)	TE564GE1/2
_____	Welding Fundamentals (EHS only)	TE624GE1/2
_____	Welding Technology I (2 Hrs.)(EHS only)	TE634GE1/2
_____	Welding Technology II (2hrs.)(EHS only)	TE654GE1/2
_____	Into to Engineer Design PLTW	TE800HN1/2
_____	Civil Engineering & Architecture, PLTW	TE820HN1/2

_____	Computer Integrated Manufacturing, PLTW	TE830HN1/2
_____	Principles of Engineering, PLTW	TE840HN1/2
_____	Digital Electronics, PLTW	TE850HN1/2
_____	Engineering Design & Development, PLTW	TE860HN1/2

WORLD LANGUAGE

_____	French 1-2	WL100GE1/2
_____	French 3-4	WL130GE1/2
_____	French 5-6	WL150GE1/2
_____	Honors French 5-6	WL150HN1/2
_____	French 7-8	WL160GE1/2
_____	Honors French 7-8	WL160HN1/2
_____	German 1-2	WL200GE1/2
_____	German 3-4	WL230GE1/2
_____	German 5-6	WL250GE1/2
_____	Honors German 5-6	WL250HN1/2
_____	German 7-8	WL260GE1/2
_____	Honors German 7-8	WL260HN1/2
_____	Spanish 1-2	WL500GE1/2
_____	Spanish 3-4	WL530GE1/2
_____	Spanish 5-6	WL550GE1/2
_____	Honors Spanish 5-6	WL550HN1/2
_____	Spanish 7-8	WL560GE1/2
_____	Honors Spanish 7-8	WL560HN1/2
_____	Span Heritage Speakers 1-2	WL600GE1/2
_____	Span Heritage Speakers 3-4	WL630GE1/2
_____	Span Heritage Speakers 5-6	WL650GE1/2
_____	Honors Span Heritage Speakers 5-6	WL655HN1/2
_____	Span Heritage Speakers 7-8	WL660GE1/2
_____	Honors Span Heritage Speakers 7-8	WL660HN1/2
_____	AP Spanish Language	WL575AP1/2
_____	AP Spanish Literature	WL580AP1/2

Read before signing

- It is the student's responsibility to secure and check his/her schedule and make a counselor appointment to correct any errors prior to each new semester. Per School District U-46 procedures requests for changes to course selections after registration will only be granted if there is space available and no requests will be granted after June 1st unless there is a documented health or safety concern.
- Signed forms **MUST** be returned to your counselor in order for your classes to be activated.
- Schedule will be computer generated.

Student Signature _____

Date _____

Parent Signature _____

Date _____

Counselor Signature _____

Date _____

NOTE: Classes on this selection sheet will be offered if they meet minimum enrollment numbers. It is imperative that students request in preferred order their 1st, 2nd, 3rd, and 4th choice of alternative/additional elective courses.

District U-46 11th Grade Course Selection Sheet for 2019/2020 School Year

Name _____ **ID#** _____ **Date of Birth** _____

Core Curriculum: Select 1 from each category below as needed for graduation requirements.

Select up to 4 electives. Prioritize your selections from 1 to 4. (Additional courses on back of this page.)

LANGUAGE ARTS

_____ Freshman English 1-2 LA100GE1/2
 _____ Sophomore English 1-2 LA200GE1/2
 _____ Junior English 1-2 LA300GE1/2
 _____ JR Eng American Studies 1-2 LA325GE1/2
 _____ AP Eng Language & Comp LA370AP1/2

MATH

_____ Algebra MA100GE1/2
 _____ Geometry MA200GE1/2
 _____ Honors Geometry MA220HN1/2
 _____ Algebra 2 MA300GE1/2
 _____ Honors Algebra 2 MA320HN1/2
 _____ Pre-Calculus MA500GE1/2
 _____ Honors Pre-Calculus MA520HN1/2
 _____ AP Calculus AB MA570AP1/2
 _____ AP Calculus BC MA575AP1/2
 _____ AP Statistics MA670AP1/2
 _____ Finite Mathematics MA700GE1/2
 _____ AP Computer Science A MA740AP1/2
 _____ AP Computer Science Principle: MA750AP1/2

PHYSICAL EDUCATION & HEALTH

_____ Functional Fitness: Mod A PE130GE3
 _____ Functional Fitness: Mod B PE135GE3
 _____ Strength & Performance: Mod PE140GE3
 _____ Strength & Performance: Mod I PE145GE3
 _____ Team Sport Officiating & Coach PE150GE3
 _____ Mod A
 _____ Team Sport Officiating & Coach PE155GE3
 _____ Mod B
 _____ Walking for Wellness: Mod A PE160GE3
 _____ Walking for Wellness: Mod B PE165GE3
 _____ Lifeguard Certification & Leader PE110GE3
 _____ Sophomore PE PE200GE3
 _____ JR/SR PE Dance PE310GE1/2
 _____ JR/SR PE Individ/Dual Sport PE320GE1/2
 _____ JR/SR PE Personal Fitness PE330GE1/2
 _____ JR/SR PE Cond & Weights PE340GE1/2
 _____ JR/SR PE Team Sports PE350GE1/2
 _____ Intro to Leadership in PE PE170GE3
 _____ Advanced Leadership in PE PE175GE3
 _____ Health Education HE010GE3

SCIENCE

_____ Biology 1-2 SC000GE1/2
 _____ Honors Biology 1-2 SC050HN1/2
 _____ AP Biology SC070AP1/2
 _____ Chemistry 1-2 SC100GE1/2
 _____ Honors Chemistry 1-2 SC100HN1/2
 _____ AP Chemistry SC170AP1/2
 _____ Geology 1-2 SC200GE1/2
 _____ Integrated Physical Science SC300GE1/2
 _____ Physics 1-2 SC400GE1/2
 _____ Honors Physics 1-2 SC400HN1/2
 _____ AP Physics C SC470AP1/2

CONT. SCIENCE

_____ AP Physics 1 SC420AP1/2
 _____ Environ Science 1-2 SC500GE1/2
 _____ AP Environ Science SC570AP1/2

SOCIAL STUDIES

_____ United States History SS200GE1/2
 _____ U.S. History-American Studies SS210GE1/2
 _____ AP United States History SS270AP1/2
 _____ Civics SS300GE3
 _____ AP Govt & Politics: US SS370AP3
 _____ Economics SS400GE3
 _____ AP Macro Economics SS470AP3

ART

_____ Discovery Draw & Painting AR000GE3
 _____ Discovery Photography AR010GE3
 _____ Discovery Sculpture AR020GE3
 _____ Ceramics 1-2 AR100GE1/2
 _____ Ceramics 3-4 AR130GE1/2
 _____ Drawing 1-2 AR200GE1/2
 _____ Drawing 3-4 AR230GE1/2
 _____ Jewelry 1-2 AR300GE1/2
 _____ Jewelry 3-4 AR330GE1/2
 _____ Painting 1-2 AR400GE1/2
 _____ Painting 3-4 AR430GE1/2
 _____ Photography 1-2 AR500GE1/2
 _____ Photography 3-4 AR530GE1/2
 _____ Sculpture 1-2 AR600GE1/2
 _____ Sculpture 3-4 AR630GE1/2
 _____ Cartoon/Animation 1-2 AR700GE1/2
 _____ Cartoon/Animation 3-4 AR730GE1/2
 _____ AP Art History GE170AP1/2

AVID

_____ Junior AVID AV300GE1/2

BUSINESS EDUCATION

_____ Computer Apps BU100GE3
 _____ Adv. Computer Apps BU200GE3
 _____ Multimedia & Design Pr BU300GE3
 _____ Intro To Global Business BU400GE3
 _____ Marketing BUS00GE3
 _____ Mgmt. & Entrepreneur BU510GE3
 _____ Entrepreneurial Intern BU520GE3
 _____ Web & Media Design BU600GE3
 _____ Adv. Web & Media Design BU700GE3
 _____ Accounting BU000GE1/2
 _____ College Accounting BU010GE1/2
 _____ Cooperative Internship 1-2 CE800GE1/2
 _____ (Class Year 1)
 _____ Cooperative Internship 1-2 CE810GE1/2
 _____ (Job)

DRAMA

_____ The Theatre Experience EN610GE3

CONT. DRAMA

_____ Actor's Workshop EN630GE3
 _____ Advanced Theatre Production EN620GE1/2

DRIVER EDUCATION

_____ Driver Education (Class) DE010GE3

FAMILY & CONSUMER SCIENCE

_____ Child Development FC100GE3
 _____ Fashion/Apparel Marketing & Merchandise FC230GE3
 _____ Childhood Education FC110GE1/2
 _____ Adv. Childhood Education FC120GE1/2
 _____ Fashion/Apparel Constr & Textile 1 FC200GE1/2
 _____ Fashion/Apparel Constr & Textile 2 FC210GE1/2
 _____ Intro To Culinary Arts FC300GE1/2
 _____ Culinary Arts FC310GE1/2
 _____ Advanced Culinary Arts FC320GE1/2
 _____ Culinary Arts & Restaurant Management (1 Hr) FC330GE1/2
 _____ Culinary Arts & Restaurant Management (2 Hr) FC340GE1/2
 _____ Cooperative Internship 1-2 (Class Year 1) CE800GE1/2
 _____ Cooperative Internship 1-2 (Job) CE810GE1/2

HEALTH CARE SCIENCE

_____ Foundations of Health Care Science HE114GE3
 _____ Fundamentals of Human Anatomy HE124GE3
 _____ Adv. Health Care Science HE214GE1/2
 _____ CNA (Certified Nursing Asst.) HE234HN1/2
 _____ Principles of Biomedical Science (H), PLTW HE514HN1/2
 _____ Human Body Systems (H), PLTW HE515HN1/2
 _____ Medical Interventions (MI), (H) PLTW HE616HN1/2
 _____ Health Care Science Internship (Class) CE716GE1/2
 _____ Health Care Science Internship (Job) CE726GE1/2
 _____ Veterinary Science 1 (Regional Pathway Program) SPRP2GE1/2

NOTE: Classes on this selection sheet will be offered if they meet minimum enrollment numbers. It is imperative that students request in preferred order their 1st, 2nd, 3rd, and 4th choice of alternative/additional elective courses.

District U-46 11th Grade Course Selection Sheet for 2019/2020 School Year

Name _____ ID# _____ Date of Birth _____

Select up to 4 electives. Prioritize your selections from 1 to 4. (Additional courses on back of this page.)

LANGUAGE ARTS					WORLD LANGUAGE
Speech Communications	LA580GE3	Intro to Law I	SS500GE3		French 1-2
Argumentation	LA590GE3	Law II	SS510GE3		French 3-4
Leadership in Action	LA650GE1/2	Intro to Psychology	SS600GE3		French 5-6
21st Century Media	LA640GE1/2	Sociology	SS620GE3		Honors French 5-6
Junior Literacy Lab	RE325GE1/2	World History	SS000GE1/2		German 1-2
Creative Writing	LA500GE1/2	AP World History	SS070AP1/2		German 3-4
Production & Publication I	LA560GE1/2	World Geography	SS100GE1/2		German 5-6
Production & Publication II	LA570GE1/2	AP Psychology	SS670AP1/2		Honors German 5-6
		AP European History	SS770AP1/2		Spanish 1-2
		AP Human Geography	SS970AP1/2		Spanish 3-4
MATH		STUDY HALL/LUNCH			Spanish 5-6
Computer Programming J 1-2	MA720GE1/2	Lunch (9-12)	SL000GE1/2		Honors Spanish 5-6
		Study Center (9-12)	SU000GE1/2		Spanish 7-8
MUSIC		TECHNOLOGY EDUCATION			Honors Spanish 7-8
Madrigal Singers	MU050GE1/2	Automotive Technology	TE114GE1/2		Span Heritage Speakers 1-2
Treble Choir	MU100GE1/2	Advanced Auto Tech	TE134GE1/2		Span Heritage Speakers 3-4
Chamber Choir	MU110GE1/2	Production Technology	TE160GE1/2		Span Heritage Speakers 5-6
Concert Choir Mixed	MU120GE1/2	(SEHS/SHS only)			Honors Span Heritage
Mellodears	MU130GE1/2	Precision Manufacturing	TE524GE1/2		Speakers 5-6
Mixed Chorus	MU140GE1/2	(2 Hrs) (SEHS/SHS only)			Span Heritage Speakers 7-8
Concert Band	MU200GE1/2	Welding Fundamentals	TE624GE1/2		Honors Span Heritage
Symphonic Band	MU210GE1/2	(EHS only)			Speakers 7-8
Wind Ensemble	MU220GE1/2	Welding Technology I	TE634GE1/2		AP Spanish Language
Jazz Band	MU230GE1/2	(2 Hrs)(EHS only)			AP Spanish Literature
Varsity Band	MU240GE1/2	Intro To Engineer Design,	TE800HN1/2		
Chamber Orchestra	MU300GE1/2	PLTW			
Concert Orchestra	MU310GE1/2	Civil Engineering &	TE820HN1/2		
Symphony Orchestra-	MU330GE1/2	Architecture, PLTW			
Philharmonic		Computer Integrated	TE830HN1/2		
Music Theory &	MU400GE1/2	Manufacturing, PLTW			
Appreciation		Principles of Engineering,	TE840HN1/2		
		PLTW			
SOCIAL STUDIES		Digital Electronics, PLTW	TE850HN1/2		
International Relations	SS050GE3	Engineering Design &	TE860HN1/2		
AP Micro Economics	SS475AP3	Development, PLTW			
AP Comparative Government	SS310AP3				
& Politics					

Read before signing

- It is the student's responsibility to secure and check his/her schedule and make a counselor appointment to correct any errors prior to each new semester. **Per School District U-46 procedures requests for changes to course selections after registration will only be granted if there is space available and no requests will be granted after June 1st unless there is a documented health or safety concern.**
- Signed forms **MUST** be returned to your counselor in order for your classes to be activated.
- Schedule will be computer generated.

Student Signature _____ Date _____

Parent Signature _____ Date _____

Counselor Signature _____ Date _____

NOTE: Classes on this selection sheet will be offered if they meet minimum enrollment numbers. It is imperative that students request in preferred order their 1st, 2nd, 3rd, and 4th choice of alternative/additional elective courses.

District U-46 10th Grade Course Selection Sheet for 2019/2020 School Year

Name _____ ID# _____ Date of Birth _____

Core Curriculum: Select 1 from each category below as needed for graduation requirements.

Select up to 4 electives. Prioritize your selections from 1 to 4. (Additional courses on back of this page.)

LANGUAGE ARTS

_____ Freshman English 1-2 LA100GE1/2
 _____ Sophomore English 1-2 LA200GE1/2
 _____ Honors Sophomore English 1-2 LA220HN1/2

MATH

_____ Algebra 1 MA100GE1/2
 _____ Geometry MA200GE1/2
 _____ Honors Geometry MA220HN1/2
 _____ Algebra 2 MA300GE1/2
 _____ Honors Algebra 2 MA320HN1/2
 _____ Pre-Calculus MA500GE1/2
 _____ Honors Pre-Calculus MA520HN1/2
 _____ AP Calculus AB MA570AP1/2
 _____ AP Calculus BC MA575AP1/2
 _____ AP Statistics MA670AP1/2
 _____ Finite Mathematics MA700GE1/2
 _____ AP Computer Science A MA740AP1/2
 _____ AP Computer Science Principle: MA750AP1/2

PHYSICAL EDUCATION & HEALTH

_____ Functional Fitness: Mod A PE130GE3
 _____ Functional Fitness: Mod B PE135GE3
 _____ Strength & Performance: Mod PE140GE3
 _____ Strength & Performance: Mod I PE145GE3
 _____ Team Sport Officiating & Coach PE150GE3
 _____ Mod A
 _____ Team Sport Officiating & Coach PE155GE3
 _____ Mod B
 _____ Walking for Wellness: Mod A PE160GE3
 _____ Walking for Wellness: Mod B PE165GE3
 _____ Lifeguard Certification & Leadership PE110GE3
 _____ Sophomore PE PE200GE3
 _____ Health Education HE010GE3

SCIENCE

_____ Biology 1-2 SC000GE1/2
 _____ Honors Biology 1-2 SC050HN1/2
 _____ Chemistry 1-2 SC100GE1/2
 _____ Honors Chemistry 1-2 SC100HN1/2
 _____ Integrated Physical Science SC300GE1/2

SOCIAL STUDIES

_____ United States History SS200GE1/2
 _____ AP United States History SS270AP1/2
 _____ Civics SS300GE3
 _____ AP Govt & Politics: US SS370AP3
 _____ Economics SS400GE3
 _____ AP Macro Economics SS470AP3

ART

_____ Discovery Draw & Painting AR000GE3
 _____ Discovery Photography AR010GE3
 _____ Discovery Sculpture AR020GE3
 _____ Ceramics 1-2 AR100GE1/2
 _____ Drawing 1-2 AR200GE1/2
 _____ Jewelry 1-2 AR300GE1/2
 _____ Painting 1-2 AR400GE1/2
 _____ Photography 1-2 AR500GE1/2
 _____ Sculpture 1-2 AR600GE1/2
 _____ Cartoon/Animation 1-2 AR700GE1/2
 _____ AP Art History GE170AP1/2

AVID

_____ Sophomore AVID AV200GE1/2

BUSINESS EDUCATION

_____ Computer Apps BU100GE3
 _____ Adv. Computer Apps BU200GE3
 _____ Multimedia & Design Pr BU300GE3
 _____ Intro To Global Business BU400GE3
 _____ Marketing BU500GE3
 _____ Mgmt. & Entrepreneur BU510GE3
 _____ Web & Media Design BU600GE3
 _____ Adv. Web & Media Design BU700GE3
 _____ Accounting BU000GE1/2

DRAMA

_____ The Theatre Experience EN610GE3
 _____ Actor's Workshop EN630GE3
 _____ Advanced Theatre Production EN620GE1/2

DRIVER EDUCATION

_____ Driver Education (Class) DE010GE3

FAMILY & CONSUMER SCIENCE

_____ Child Development FC100GE3
 _____ Fashion/Apparel Marketing & Merchandise FC230GE3
 _____ Childhood Education FC110GE1/2
 _____ Fashion/Apparel Constr & Textile 1 FC200GE1/2
 _____ Fashion/Apparel Constr & Textile 2 FC210GE1/2
 _____ Intro To Culinary Arts FC300GE1/2
 _____ Culinary Arts FC310GE1/2

HEALTH CARE SCIENCE

_____ Foundations of Health Care Science HE114GE3
 _____ Fundamentals of Human Anatomy HE124GE3
 _____ Adv. Health Care Science HE214GE1/2

_____ Principles of Biomedical Science (PBS), PLTW HE514HN1/2
 _____ Human Body Systems (HBS), PLTW HE515HN1/2
 _____ Veterinary Technology (Regional Pathway Program) SPRP1GE1/2

LANGUAGE ARTS

_____ Speech Communications LA580GE3
 _____ Argumentation LA590GE3
 _____ 21st Century Media LA640GE1/2
 _____ Leadership in Action LA650GE1/2
 _____ Sophomore Literacy Lab RE225GE1/2
 _____ Creative Writing LA500GE1/2
 _____ Production & Publication I LA560GE1/2
 _____ Production & Publication II LA570GE1/2

MATH

_____ Computer Programming J 1-2 MA720GE1/2

MUSIC

_____ Madrigal Singers MU050GE1/2
 _____ Treble Choir MU100GE1/2
 _____ Chamber Choir MU110GE1/2
 _____ Concert Choir Mixed MU120GE1/2
 _____ Mellodears MU130GE1/2
 _____ Mixed Chorus MU140GE1/2
 _____ Concert Band MU200GE1/2
 _____ Symphonic Band MU210GE1/2
 _____ Wind Ensemble MU220GE1/2
 _____ Jazz Band MU230GE1/2
 _____ Varsity Band MU240GE1/2
 _____ Chamber Orchestra MU300GE1/2
 _____ Concert Orchestra MU310GE1/2
 _____ Symphony Orchestra-Philharmonic MU330GE1/2

SOCIAL STUDIES

_____ International Relations SS050GE3
 _____ AP Micro Economics SS475AP3
 _____ AP Comparative Government & Politics SS310AP3
 _____ Intro to Law I SS500GE3
 _____ Law II SS510GE3
 _____ Intro to Psychology SS600GE3
 _____ Sociology SS620GE3
 _____ World History SS000GE1/2
 _____ AP World History SS070AP1/2
 _____ World Geography SS100GE1/2
 _____ AP European History SS770AP1/2
 _____ AP Human Geography SS970AP1/2
 _____ AP Psychology SS670AP1/2

NOTE: Classes on this selection sheet will be offered if they meet minimum enrollment numbers. It is imperative that students request in preferred order their 1st, 2nd, 3rd, and 4th choice of alternative/additional elective courses.

District U-46 10th Grade Course Selection Sheet for 2019/2020 School Year

Name _____ ID# _____ Date of Birth _____

Select up to 4 electives. Prioritize your selections from 1 to 4. (Additional courses on back of this page.)

STUDY HALL/LUNCH

_____ Lunch (9-12) SL000GE1/2
 _____ Study Center (9-12) SU000GE1/2

TECHNOLOGY EDUCATION

_____ Production Technology TE160GE1/2
 (SEHS/SHS only)
 _____ Automotive Technology TE114GE1/2
 _____ Welding Fundamentals TE624GE1/2
 (EHS only)
 _____ Intro To Engineer Design, TE800HN1/2
 PLTW
 _____ Computer Integrated TE830HN1/2
 Manufacturing, PLTW
 _____ Principles of Engineering, TE840HN1/2
 PLTW

WORLD LANGUAGE

_____ French 1-2 WL100GE1/2
 _____ French 3-4 WL130GE1/2
 _____ German 1-2 WL200GE1/2
 _____ German 3-4 WL230GE1/2
 _____ Spanish 1-2 WL500GE1/2
 _____ Spanish 3-4 WL530GE1/2
 _____ Spanish 5-6 WL550GE1/2
 _____ Honors Spanish 5-6 WL550HN1/2
 _____ Span Heritage Speakers 1-2 WL600GE1/2
 _____ Span Heritage Speakers 3-4 WL630GE1/2
 _____ Span Heritage Speakers 5-6 WL650GE1/2
 _____ Honors Span Heritage WL655HN1/2
 Speakers 5-6
 _____ AP Spanish Language WL575AP1/2
 _____ AP Spanish Literature WL580AP1/2

ALTERNATIVE SELECTIONS

1st Choice _____ Course Code _____

2nd Choice _____ Course Code _____

3rd Choice _____ Course Code _____

4th Choice _____ Course Code _____

Read before signing

- It is the student's responsibility to secure and check his/her schedule and make a counselor appointment to correct any errors prior to each new semester. **Per School District U-46 procedures requests for changes to course selections after registration will only be granted if there is space available and no requests will be granted after June 1st unless there is a documented health or safety concern.**
- Signed forms **MUST** be returned to your counselor in order for your classes to be activated.
- Schedule will be computer generated.

Student Signature _____

Date _____

Parent Signature _____

Date _____

Counselor Signature _____

Date _____

NOTE: Classes on this selection sheet will be offered if they meet minimum enrollment numbers. It is imperative that students request in preferred order their 1st, 2nd, 3rd, and 4th choice of alternative/additional elective courses.

District U-46 9th Grade Course Selection Sheet for 2019/2020 School Year

Name _____ ID# _____ Date of Birth _____

Core Curriculum: Select 1 from each category below as needed for graduation requirements.

Select up to 4 electives. Prioritize your selections from 1 to 4.

LANGUAGE ARTS

_____ Freshman English 1-2 LA100GE1/2
 _____ Honors Freshman English1-2 LA120HN1/2

MATH

_____ Algebra 1 MA100GE1/2
 _____ Geometry MA200GE1/2
 _____ Honors Geometry MA220HN1/2
 _____ Algebra 2 MA300GE1/2
 _____ Honors Algebra 2 MA320HN1/2
 _____ Geometry Bridge MA205GE1/2
 _____ Pre-Calculus MA500GE1/2
 _____ Honors Pre-Calculus MA520HN1/2
 _____ AP Calculus AB MA570AP1/2
 _____ AP Calculus BC MA575AP1/2
 _____ AP Statistics MA670AP1/2
 _____ Finite Mathematics MA700GE1/2
 _____ AP Computer Science A MA740AP1/2
 _____ AP Computer Science Principle: MA750AP1/2

PHYSICAL EDUCATION & HEALTH

_____ Functional Fitness: Mod A PE130GE3
 _____ Functional Fitness: Mod B PE135GE3
 _____ Strength & Performance: Mod PE140GE3
 _____ Strength & Performance: Mod I PE145GE3
 _____ Team Sport Officiating & Coach PE150GE3
 _____ Mod A
 _____ Team Sport Officiating & Coach PE155GE3
 _____ Mod B
 _____ Walking for Wellness: Mod A PE160GE3
 _____ Walking for Wellness: Mod B PE165GE3
 _____ Lifeguard Certification & Leader PE110GE3

SCIENCE

_____ Biology 1-2 SC000GE1/2
 _____ Honors Biology 1-2 SC050HN1/2

ART

_____ Discovery Draw & Painting AR000GE3
 _____ Discovery Photography AR010GE3
 _____ Discovery Sculpture AR020GE3

AVID

_____ Freshman AVID AV100GE1/2

BUSINESS EDUCATION

_____ Computer Apps BU100GE3
 _____ Adv. Computer Apps BU200GE3
 _____ Multimedia & Design Pr BU300GE3
 _____ Intro To Global Business BU400GE3

DRAMA

_____ The Theatre Experience LA610GE3
 _____ Actor's Workshop LA630GE3
 _____ Advanced Theatre Production LA620GE1/2

DRIVER EDUCATION

_____ Driver Education (Class) DE010GE3

FAMILY & CONSUMER SCIENCE

_____ Child Development FC100GE3
 _____ Fashion/Apparel Constr & Textile 1 FC200GE1/2
 _____ Intro To Culinary Arts FC300GE1/2

HEALTH CARE SCIENCE

_____ Foundations of Health HE114GE3
 _____ Care Science
 _____ Fundamentals of Human Anatomy HE124GE3

LANGUAGE ARTS

_____ Speech Communications LA580GE3
 _____ Argumentation LA590GE3
 _____ 21st Century Media LA640GE1/2
 _____ Freshman Literacy Lab RE125GE1/2
 _____ Creative Writing LA500GE1/2
 _____ Production & Publication I LA560GE1/2
 _____ Production & Publication II LA570GE1/2

MATH

_____ Computer Programming J 1-2 MA720GE1/2

MUSIC

_____ Treble Choir MU100GE1/2
 _____ Concert Choir Mixed MU120GE1/2
 _____ Mellodears MU130GE1/2
 _____ Mixed Chorus MU140GE1/2
 _____ Concert Band MU200GE1/2
 _____ Symphonic Band MU210GE1/2
 _____ Wind Ensemble MU220GE1/2
 _____ Jazz Band MU230GE1/2
 _____ Varsity Band MU240GE1/2
 _____ Chamber Orchestra MU300GE1/2
 _____ Concert Orchestra MU310GE1/2
 _____ Symphony Orchestra-Philharmonic MU330GE1/2

SOCIAL STUDIES

_____ International Relations SS050GE3
 _____ Intro to Law I SS500GE3
 _____ Law II SS510GE3
 _____ Intro to Psychology SS600GE3
 _____ Sociology SS620GE3
 _____ World History SS000GE1/2
 _____ AP World History SS070AP1/2
 _____ World Geography SS100GE1/2
 _____ AP European History SS770AP1/2
 _____ AP Human Geography SS970AP1/2

STUDY HALL/LUNCH

_____ Lunch (9-12) SL000GE1/2
 _____ Study Center (9-12) SU000GE1/2

TECHNOLOGY EDUCATION

_____ Intro To Engineer Design, PLTW TE800HN1/2

WORLD LANGUAGE

_____ French 1-2 WL100GE1/2
 _____ German 1-2 WL200GE1/2
 _____ Spanish 1-2 WL500GE1/2
 _____ Spanish 3-4 WL530GE1/2
 _____ Span Heritage Speakers 1-2 WL600GE1/2
 _____ Span Heritage Speakers 3-4 WL630GE1/2
 _____ AP Spanish Language WL575AP1/2
 _____ AP Spanish Literature WL580AP1/2

NOTE: Classes on this selection sheet will be offered if they meet minimum enrollment numbers. It is imperative that students request in preferred order their 1st, 2nd, 3rd, and 4th choice of alternative/additional elective courses.

District U-46 9th Grade Course Selection Sheet for 2019/2020 School Year

Name _____ ID# _____ Date of Birth _____

1ST SEMESTER CLASSES	2ND SEMESTER CLASSES
1. LUNCH SL000GE1	1. LUNCH SL000GE2
2. STUDY CENTER 9 SU000GE1	2. STUDY CENTER 9 SU000GE2
3. FRESHMAN P.E. PE010GE1/2	3. FRESHMAN P.E. PE010GE1/2
4. FRESHMAN ENGLISH EN _____	4. FRESHMAN ENGLISH EN _____
5. BIOLOGY SC _____	5. BIOLOGY SC _____
6. MATH MA _____	6. MATH MA _____
7. ELECTIVE _____	7. ELECTIVE _____
8. ELECTIVE _____	8. ELECTIVE _____

ALTERNATIVE SELECTIONS

1st Choice _____	Course Code _____	_____
2nd Choice _____	Course Code _____	_____
3rd Choice _____	Course Code _____	_____
4th Choice _____	Course Code _____	_____

Read before signing

- It is the student's responsibility to secure and check his/her schedule and make a counselor appointment to correct any errors prior to each new semester. Per School District U-46 procedures requests for changes to course selections after registration will only be granted if there is space available and no requests will be granted after June 1st unless there is a documented health or safety concern.
- Signed forms **MUST** be returned to your counselor in order for your classes to be activated.
- Schedule will be computer generated.

Student Signature _____

Date _____

Parent Signature _____

Date _____

NOTE: Classes on this selection sheet will be offered if they meet minimum enrollment numbers. It is imperative that students request in preferred order their 1st, 2nd, 3rd, and 4th choice of alternative/additional elective courses.

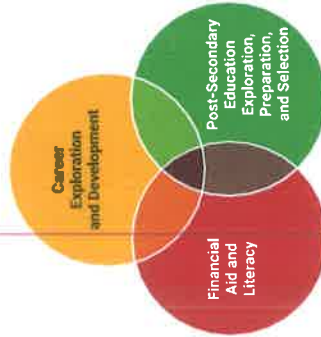
Illinois PaCE Postsecondary and Career Expectations

Each student should have an individualized learning plan to help make decisions about career and post-secondary (PS) education or training, to plan a course of study, and to make financial aid assessments with family members.



By the end of 8th grade

- A student should be supported to:**
- complete a career cluster survey
 - attend a career exploration day
 - complete a unit on education planning
 - be exposed to a financial literacy unit in a course or workshop
- A student should know:**
- the concept of career clusters of interest
 - relationship between community service/extracurricular activities and postsecondary (PS)/career goals



By the end of 9th grade

- A student should be supported to:**
- revisit career cluster interest survey and take a career interest survey
 - complete an orientation to career clusters
 - attend a PS options workshop
 - meet with a counselor to discuss coursework and PS/career plans using the ISBE College and Career Readiness Indicators
 - begin determining eligibility for advanced placement (AP) courses
 - outline a plan for community service and extracurricular activities related to PS plans
 - complete a financial aid assessment with a family member
- A student should know:**
- one or two career clusters for further exploration and development
 - the relationship between HS coursework, attendance, and grades to PS plans
 - importance of community service and extracurricular activities to PS and career plans
 - general cost ranges of various PS options

By the end of 10th grade

- A student should be supported to:**
- visit at least one workplace aligned with career interests
 - complete an orientation course to a particular career cluster or cluster grouping
 - select a career pathway (CP) within a career cluster of interest
 - begin determining eligibility for AP courses
 - identify 2-3 adults to support the student through the PS and career selection process
 - review coursework, and PS/career plans in relation to the ISBE College and Career Readiness Indicators (every year)
 - attend a PS affordability workshop with a family member
- A student should know:**
- educational requirements, cost, expected entry level, and midpoint salary for occupations in selected CP
 - different types of PS credentials and institutions
 - general timing of PS entrance exams and applications
 - benefit of early college credit opportunities to PS access and completion

By the end of 11th grade

- A student should be supported to:**
- revisit the career survey
 - participate in a mock job interview
 - create a resume and personal statement
 - identify an internship opportunity related to the CP
 - determine readiness for college-level coursework in math/ELA and enrollment in either "catch up" or "speed up" course
 - complete or enroll in at least one early college credit opportunity
 - attend a college fair
 - visit at least 3 PS institutions
 - take at least one college entrance exam
- A student should know:**
- application deadlines, test timing, cost, and preparation for industry-based certification for CP
 - career attributes related to career interests
 - entrance requirements, including application deadlines, for expected PS programs of study
 - 3-5 match schools, one safety, one reach school for PS program of study
 - negative impact of remediation on PS goals
 - financial aid deadlines for chosen PS options

By the end of 12th grade

- By 12/31 of 12th grade a student should have:**
- completed 3 or more admissions applications to PS institutions
 - met with a school counselor to ensure all steps in the PS admissions process are completed on time
 - attended a FAFSA completion workshop
 - completed the FAFSA
- By the end of 12th grade a student should be supported to:**
- address any remedial needs in math/ELA
 - obtain an internship opportunity related to the CP
 - if applicable, receive industry-based certification(s) related to the CP
 - complete one or more team-based challenges or projects related to the CP
 - attend a financial aid award letter workshop
- A student should know:**
- how CP courses and experiences articulate to degree programs at PS options
 - estimated cost of each PS option
 - affordability of PS options in relation to expected entry-level career salary and anticipated debt
 - terms and conditions of any scholarship or loan



Naviance Aligned PaCE Individualized Learning Plan

Grade 12

PaCE Expectations

Naviance Alignment

By 12/31 of 12th grade a student should have:

Completed 3 or more admission applications to PS institutions
 Met with a school counselor to ensure all steps in the PS admission process are completed on time
 Attended a FAFSA completion workshop
 Completed the FAFSA

Student applies to at least 3 colleges
 Task marked as complete by counselor when student meets with counselor to complete Senior Year Planning Meeting
 Student completes a custom FAFSA Workshop reflection
 Options:
 - Task is marked complete by counselor
 - Student completes a custom FAFSA completion survey
 - Task is automatically complete via backend tool by consultant

By the end of 12th grade a student should be supported to:

Address any remedial needs in Math/ELA
 Obtain an internship opportunity relating to CP
 If applicable, receive industry-based certification(s) relating to CP
 Complete one or more team based challenges or projects relating to CP
 Attend a financial aid award letter workshop

Task marked as complete by counselor when student meets with counselor to complete Senior Planning Meeting
 Options:
 - Student completes an Internship Planning Survey
 - Student updates resume
 Student uploads evidence of certification completion
 Student completes a custom reflection survey
 Student completes a custom reflection survey

A student should know:

How CP courses and experiences articulate to degree programs at PS options
 Estimated cost of each PS option
 Affordability of PS options in relation to expected entry-level career salary and anticipated debt
 Terms and conditions of any scholarship or loan

Student completes a custom Post-Secondary Options Survey
 Student completes a custom Post-Secondary Options Survey
 Student completes a custom Post-Secondary Options Survey
 Student applies for at least one scholarship

Grade 11

PaCE Expectations

Naviance Alignment

By the end of 12th grade a student should be supported to:

Revisit the career survey

Participate in a mock job interview

Create a resume and personal statement

Identify an internship opportunity related to CP

Determine readiness for college-level coursework in Math/ELA and enrolled in either "catch up" or "speed up" course

Complete or enroll in at least one early college credit opportunity

Attend a college fair

Visit at least 3 PS institutions

Take at least one college entrance exam

Student completes Career Interest Profiler

Options

- Task is marked completed by counselor
- Student completes a custom Mock Job Interview survey

Student creates a resume and student uploads personal statement

Student completes an Enrichment Program search

Task marked as complete by counselor when student completes their Post-Secondary Planning Meeting

A student should know:

App deadlines, test timing, cost, and prep for industry based certification for CP

Career attributes related to career interests

Entrance requirements, including app deadlines, for expected PS program of study

3-5 match schools, one safety, and one reach school for PS program of study

Negative impact of remediation on PS goals

Financial aid deadlines for chosen PS options

Student attends a college fair

Complete a college visit reflection survey

Student takes the ACT or SAT

Task marked as complete by counselor when student completes their Post-Secondary Planning Meeting

Student adds at least 3 careers to their Favorites List

Student completes a College Planning Survey

Student completes a SuperMatch College Search and adds at least 5 colleges to their Favorites List

Student completes a College Planning Survey

Student completes a College Planning Survey

Grade 10

PaCE Expectations

Naviance Alignment

By the end of 12th grade a

Visit at least one workplace aligned to career interests

Options:

- Task marked complete by staff member when student attends a workplace visit
- Student completes a Workplace Visit Reflection survey

Complete an orientation course to a particular career cluster or cluster grouping

Select a career pathway (CP) within a career cluster of interest

Begin determining eligibility for AP courses

Identify 2-3 adults to support him/her through the college and career selection process

Attend a college affordability workshop with adult family member

Educational requirements, cost, expected entry level, and midpoint salary for occupations in selected CP

Different types of PS credentials and institutions

General timing of college entrance exams and apps

Benefit of early college credit opportunities to PS access and completion

TBD

Student completes Do What You Are adds at least three careers to their Favorites List

Student completes a custom Post-Secondary Planning Survey

Student completes a custom Post-Secondary Planning Survey

Options:

- Task marked complete by staff member when student attends Affordability Workshop
- Task marked complete when student completes an Affordability Workshop Reflection Survey

Student adds at least three careers to their Favorites List

Student completes a custom Post-Secondary Planning Survey

Student completes a custom Post-Secondary Planning Survey

Student completes a custom Post-Secondary Planning Survey

A student should know:

Grade 9

PaCE Expectations

Revisit career cluster survey and take a career interest survey
Complete an orientation to career clusters

Attend a postsecondary (PS) options workshop

Meet with a counselor to discuss coursework and postsecondary/career plans

Naviance Alignment

Student completes StrengthsExplorer

Student completes a custom Post-Secondary Options survey

Options:

- Task marked complete by staff member when student attends PS Options Workshop
- Task marked complete when student completes a Post-Secondary Options Survey

Task marked as complete by counselor when student completes High School Planning meeting

By the end of 12th grade a student should be supported

Task marked as complete by counselor when student completes High School Planning meeting

Student completes a Community Service and Extracurricular Planning Survey

Student completes an EFC Completion Survey

Student complete Career Cluster Finder and adds at least 1 career cluster to their Favorites List

Student completes a custom Post-Secondary Options survey

Student completes a custom Post-Secondary Options survey

Student completes a College Profile Scavenger Hunt

Begin determining eligibility for AP courses

Outline a plan for community service/ extracurricular activities related to PS plans

Complete a financial aid assessment with a family member

One or two career clusters for further exploration and development

The relationship between HS coursework, attendance, and grades to PS plans

Importance of community service and extracurricular activities to PS and career plans

General cost ranges of various PS options

A student should know

Grade 8

Naviance Alignment

PaCE Expectations

By the end of 12th grade a student should be supported	<p>Complete a career cluster survey</p> <p>Attend a career exploration day</p> <p>Complete a unit on education planning</p> <p>Be exposed to a finance literacy unit in a course or workshop</p> <p>The concept of career clusters for further exploration</p> <p>Possible career clusters of interest</p> <p>Relationship between community service/extracurricular activities and postsecondary (PS)/career goals</p>	<p>Student complete Career Cluster Finder and adds at least 1 career cluster to their Favorites List</p> <p>Options:</p> <ul style="list-style-type: none"> - Task marked complete by staff member when student attends career day - Task marked complete when student completes a Career Day Reflection Survey <p>TBD</p> <p>TBD</p> <p>Student adds at least 1 career cluster to their Favorites List</p> <p>Student adds at least 1 career cluster to their Favorites List</p> <p>Student completes a High School Transition Survey</p>
A student should know:		

HARBOR FREIGHT

TOOLS FOR SCHOOLS

Press Release

EMBARGOED UNTIL 9:30 AM THURSDAY, NOV. 15, 2018

ILLINOIS HIGH SCHOOL PRECISION MANUFACTURING TEACHER WINS SECOND-PLACE IN 2018 HARBOR FREIGHT TOOLS FOR SCHOOLS PRIZE FOR TEACHING EXCELLENCE

Streamwood Teacher, High School Share \$50,000 Award

For Immediate Release:
Thursday, Nov. 15, 2018

Contact: Karen Denne
818-836-5272
kdenne@hftforschools.org

STREAMWOOD, Ill.—A precision manufacturing teacher from Streamwood has won second-place in the 2018 Harbor Freight Tools for Schools Prize for Teaching Excellence, earning him and his high school skilled trades program \$50,000 as part of \$1 million awarded nationally.

Matt Erbach, who teaches precision manufacturing at Streamwood High School, was surprised in his classroom today by a representative from Harbor Freight Tools for Schools with the news that he and his school will receive \$50,000—\$35,000 for the school’s skilled trades program and \$15,000 for him.

“The creativity and hands-on projects that Mr. Erbach and the other winning teachers bring to their classrooms is an inspiration,” said Danny Corwin, executive director of Harbor Freight Tools for Schools. “This is education at its best, and we are humbled to honor these teachers and shine a light on excellence in skilled trades education.”

Three \$100,000 first-place prizes were awarded to a welding teacher from Georgia, a building trades teacher from Michigan and an industrial diesel mechanics teacher from Ohio, with the prize winnings split between the individual teacher or team and their high school skilled trades program. Fifteen second-place winners across the country, including Erbach, were also surprised with the news that they and their schools had won the cash award. In addition to the more than \$1 million in first- and second-place prizes awarded by Harbor Freight Tools for Schools, the company Harbor Freight Tools donated \$34,000 to 34 semi-finalists.

The prize was started in 2017 by Harbor Freight Tools Founder Eric Smidt to recognize extraordinary public high school skilled trades teachers and programs with a proven track record of dedication and performance. The prize is awarded by Harbor Freight Tools for Schools, a program of The Smidt Foundation.

HARBOR FREIGHT TOOLS FOR SCHOOLS
26541 Agoura Road
Calabasas, California 91302

“These incredible teachers are an inspiration—to their students, to their communities and to us,” said Eric Smidt, Harbor Freight Tools founder. “They are masters of their trades and instill in their students a passion for the skilled trades that gives them a path to a meaningful, good-paying career. These are local jobs in every community across America, building and repairing homes, fixing cars and appliances, and so much more. We’re honored to be able to recognize these teachers for inspiring and developing the future workforce our country needs.”

Matt Erbach has taught precision manufacturing at Streamwood High School for the past 12 years after working for five years in the manufacturing, carpentry and commercial construction trades. As a National Institute for Metalworking Skills (NIMS) and a Project Lead the Way certified instructor, Erbach provides his students with ample machine time in one of the largest high school precision manufacturing labs in the country. Erbach was also a semifinalist for the 2017 Harbor Freight Tools for Schools Prize for Teaching Excellence.

“I love just about every part of the instructional aspects of my job,” Erbach wrote in his prize application. “The ‘light bulb’ moment when a student realizes that geometry or chemistry is relevant to the real world is a fantastic experience.”

Erbach utilizes project-based learning in his classroom, and emphasizes the requirement that each student treats one another with the utmost professionalism and respect in a physically and emotionally safe environment. With hands-on learning and thoughtful guidance, students design and produce custom tools, vehicle shift knobs, whistles and more. Additionally, Erbach integrates academic subjects into his coursework and brings the real world into the classroom, from designing custom fidget spinners to staging mock interviews with the Precision Manufacturing Advisory Board.

“Often times students don’t realize that their job choices in the skilled trades represent a clear path to the middle class, a house, a family and all of the rest of the American dream, despite the fact that they have been told since elementary school that college is the only path to prosperity,” Erbach said.

The first-place winners of the 2018 prize are Gary Bronson, an industrial diesel mechanics teacher at Laurel Oaks Career Campus in Wilmington, Ohio, Charles Kachmar, who teaches metals and welding at Maxwell High School of Technology in Lawrenceville, Georgia, and Andrew J. Neumann, a building trades teacher at Bay Arenac Intermediate School District Career Center in Bay City, Michigan. Kachmar and Neumann will each receive \$100,000—\$70,000 for the school’s skilled trades program and \$30,000 for the teacher. Because of Ohio’s state policy regarding individual cash awards to public employees, Bronson’s school will receive the entire prize winnings.

The school’s prize winnings will support the skilled trades program being recognized, and the teacher’s or teacher team winnings can be used at their discretion.

HARBOR FREIGHT TOOLS FOR SCHOOLS

26541 Agoura Road
Calabasas, California 91302

The 2018 prize drew more than 550 applications from 49 states and included three rounds of judging, each by an independent panel that included experts from industry, education, trades, philanthropy and civic leadership. The field was narrowed this summer to 52 semi-finalists. The application process, which included responses to questions and a series of online video learning modules, was designed to solicit each teacher's experience, insights and creative ideas about their approach to teaching and success in helping their students achieve excellence in the skilled trades. All learning modules are available [here](#).

For a list of the other 14 second-place winners, click [here](#). The high schools of the remaining 34 semi-finalists will each receive a \$1,000 Harbor Freight Tools gift card to support their skilled trades programs. The list of the semifinalists is available [here](#).

For more information about the Harbor Freight Tools for Schools Prize for Teaching Excellence, including the final round panels of judges, please visit hftforschoolsprize.org.

About Harbor Freight Tools for Schools

Harbor Freight Tools for Schools is an initiative of The Smidt Foundation, established by Harbor Freight Tools Founder Eric Smidt, to support the advancement of skilled trades education in America. With a deep respect for the dignity of these fields and for the intelligence and creativity of people who work with their hands, this program was created to foster and shine a light on excellence in skilled trades education in public high schools. Believing that access to quality skilled trades education gives high school students pathways to graduation, opportunity, good jobs and a workforce our country needs, Harbor Freight Tools for Schools aims to stimulate greater understanding, support and investment by public entities and others in skilled trades education. Harbor Freight Tools is a major supporter of the Harbor Freight Tools for Schools program. For more information, visit harborfreighttoolsforschools.org.

#####

HARBOR FREIGHT TOOLS FOR SCHOOLS

26541 Agoura Road
Calabasas, California 91302



See our Sales Flyers!

Education »

Streamwood High precision manufacturing program, instructor awarded \$50,000



Madhu Krishnamurthy

Follow 1,168 followers

Updated

11/15/2018 4:36 PM



Matt Erbach, precision manufacturing instructor at Streamwood High School, center, was surprised by Brian Cohen of Harbor Freight Tools for Schools, left, and Streamwood High School Principal Michele Chapman with an award Thursday morning for being among the best skilled-trades teachers in the nation. Erbach was awarded \$15,000, and the school gets \$35,000. (Brian Hill | Staff Photographer)

Buy Photo

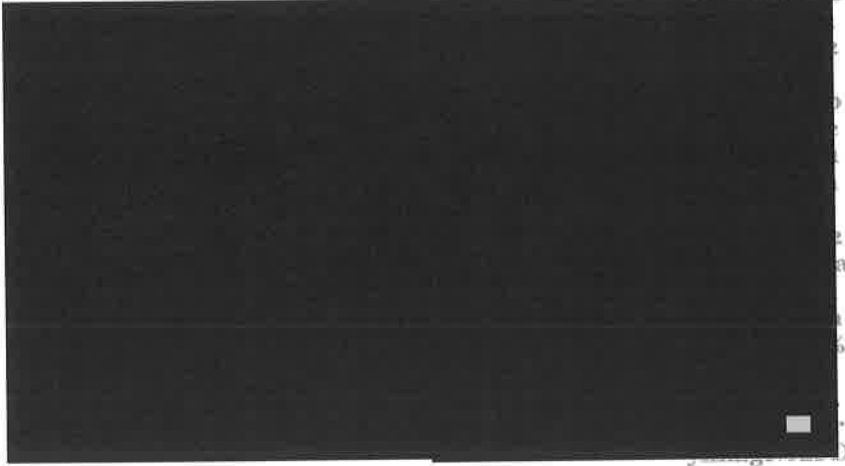
(http://daily...
backtext=Cli...
ek%20here%

Show photos

Matt Erbach says teaching students how to fabricate precisely down to a thousandth of an inch is the best part of his job.

"I love the precision ... the getting it right aspect of it," said Erbach, one of two precision manufacturing instructors at Elgin Area School District U-46. "Just working with a developing student and honing that ability to get it on target, it's a lot of fun."

ADVERTISING



inRealTime 20181119

Erbach, 39, who has been

teaching precision manufacturing at Streamwood High School for 13 years, was recognized Thursday among the best skilled-trades teachers in the nation. He is among 18 teachers singled out for the 2018 Harbor Freight Tools for Schools Prize for Teaching Excellence. Three teachers were first-place winners and 15, including Erbach, got second-place awards. Erbach is the only winner from Illinois.

A representative of Harbor Freight Tools for Schools (<http://harborfreighttoolsforschools.org>) surprised Erbach with a \$50,000 check and a large rolling toolbox during his advanced precision manufacturing class at Streamwood High.

Finalists were selected from among a pool of more than 550 applicants from 49 states pared down after three rounds of judging, Harbor Freight spokeswoman Karen Denne said.

"Winners were chosen based on the teachers' dedication to the trade, their success in connecting their students to career pathways, and their ability to network and connect students with

15%2FNEWS
%2F1811193
12%2FAR%2
F%2FAR-
181119312.jp
d%3D201811
131030%20a
mp%3Bmax
w%3D800%2
d15p%3Bma
xh%3D800&
imgsheeti
d=1690&pho
tographerid
=0&affphoto
grapherid=1
&affphotogra
pherid=1
ian%20Hill
%20%7C%20
Staff%20Pho
tographer&n
otes=)

outside opportunities," Denne said. "These teachers are extraordinarily passionate about their skilled trade and instill that passion in their students."

Streamwood and South Elgin high schools applied for the award last year and placed among the top 56 high schools in the country.

"I'm very proud of earning a second-place award," Erbach said. "U-46 has really deep roots with this program -- at Streamwood since it opened in 1978. We have good equipment. We have good facilities. Our curriculum is up-to-date. We are doing well by the students by keeping the program rigorous and engaging."

Of the \$50,000 award, \$15,000 goes to Erbach to use at his discretion and Streamwood High gets \$35,000 to support its skilled trades program.

Erbach plans to use his share to pay off student loans and put the school's money toward supporting students at skilled trades competitions.

Last year, Streamwood High's automated manufacturing technology team placed second in the SkillsUSA state championships and 10th among high school teams in the national contest.

"I'm hoping to pull a first this year," said Erbach of the state contest in April. "It would be nice to focus the students' efforts on practice and training and we don't have to fundraise this year."

SPONSORED CONTENT



How to Grow Your Business as a Leader

by Dell Technologies

CISOs need to develop certain skills to stay relevant and effective in their evolving role

Topics in this Article

Matt Erbach, Streamwood High School, Harbor Freight Tools, Elgin, Schools Prize, Karen Denne