

Title 7: Education K-12

Part 63: Precision Machining



2015 Precision Machining

Mississippi Department of Education

Program CIP: 48.0503 Machine Shop Technology/Assistant.

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The Research and Curriculum Unit (RCU), located in Starkville, MS, as part of Mississippi State University, was established to foster educational enhancements and innovations. In keeping with the land grant mission of Mississippi State University, the RCU is dedicated to improving the quality of life for Mississippians. The RCU enhances intellectual and professional development of Mississippi students and educators while applying knowledge and educational research to the lives of the people of the state. The RCU works within the contexts of curriculum development and revision, research, assessment, professional development, and industrial training.

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Dr. Carey M. Wright, State Superintendent of Education
Dr. John R. Kelly, Chair
Mr. Richard Morrison, Vice-Chair
Dr. O. Wayne Gann
Mrs. Kami Bumgarner
Mr. William Harold Jones
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Mr. Danny J. Spreitler
Mr. Johnny Franklin

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Betsey Smith, Associate Director for the Research and Curriculum Unit at Mississippi State University

Scott Kolle, Project Manager for the Research and Curriculum Unit at Mississippi State University

Jolanda Young, Educational Technologist for the Research and Curriculum Unit at Mississippi State University

Preface

Secondary career and technical education programs in Mississippi face many challenges resulting from sweeping educational reforms at the national and state levels. Schools and teachers are increasingly being held accountable for providing true learning activities to every student in the classroom. This accountability is measured through increased requirements for mastery and attainment of competency as documented through both formative and summative assessments.

The courses in this document reflect the statutory requirements as found in Section 37-3-49, *Mississippi Code of 1972*, as amended (Section 37-3-46). In addition, this curriculum reflects guidelines imposed by federal and state mandates (Laws, 1988, Ch. 487, §14; Laws, 1991, Ch. 423, §1; Laws, 1992, Ch. 519, §4 eff. from and after July 1, 1992; Carl D. Perkins Vocational Education Act IV, 2007; and No Child Left Behind Act of 2001).

Pathway Description

The Precision Machining pathway is designed as a secondary program for preparation to enter the field of precision machining and metal turning. The Precision Machining program includes an introduction to the basic machining metalworking processes. The purpose of the course is to prepare students to continue study in a postsecondary metals program (Precision Machining, Machine Tool Operation, and Automotive Machining) or to begin work at the entry level in a machining occupation. The machining courses found in this curriculum were written to the National Institute for Metalworking Skills (NIMS) credentialing standards.

Industry Certification

The NIMS is a nationally-recognized nonprofit organization that was established in 1995 to help develop industry standards to maintain the United States' global competitiveness. NIMS sets industry standards and certifies individuals who meet the quality requirements contained in the industry standards. NIMS also accredits training programs and facilities that meet NIMS' quality requirements. The NIMS organization and standards are accredited by the American National Standards Institute (ANSI) in the metalworking field.

NIMS metalworking standards reflect expertise in areas such as stamping, press brake, roll forming, machining, tool-and-die making, mold making, screw machining, and machine maintenance and repair. All NIMS standards are industry written and industry validated and subjected to regular, periodic reviews under the procedures accredited and audited by ANSI.

The NIMS Level 1 credential consists of bench work, layout, milling, drill press, surface grinding, and lathing between centers. The students are required to perform a NIMS-approved project in each area in order to attain credentialing in those areas. The student must be able to complete the NIMS project with 100% accuracy before being allowed to take an additional online written test. Once both the performance evaluation and the online test are administered and passed, the student will receive a NIMS certification for each area successfully completed, that is, bench work, layout, milling, drill press, surface grinding, and lathing between centers. The NIMS organization awards credentials for each area of competency in the Level 1 module after successful completion of projects and written tests.

NIMS credentials are used throughout the United States by industry to recruit, hire, place, and promote individual workers. NIMS may also be used to measure performance of individuals pursuing metalworking careers. Articulation may be established using the NIMS credentials for articulation among training programs.

Students who study basic machine metalworking processes may pursue, at their cost, a certification with the National Institute for Metalworking Skills, Inc. (NIMS). Students who study this curriculum may pursue certification of the NIMS Level 1 standards for machining.

Attaining this certification is optional for the student; therefore, the student is responsible for the financial costs attributed with achievement of the certification.

Assessment

The latest assessment blueprint for the curriculum can be found at: <http://www.rcu.msstate.edu/Curriculum/CurriculumDownload.aspx>

Student Prerequisites

In order for students to be able to experience success in the program, the following student prerequisites are suggested:

1. C or higher in English (the previous year)
2. C or higher in Math (last course taken or the instructor can specify the math)
3. Instructor Approval and TABE Reading Score (eighth grade or higher)

or

1. TABE Reading Score (eighth grade or higher)
2. Instructor Approval

or

1. Instructor Approval

Teacher Licensure

The latest teacher licensure information can be found at <http://www.mde.k12.ms.us/educator-licensure>

Professional Learning

If you have specific questions about the content of any of training sessions provided, please contact the Research and Curriculum Unit at 662.325.2510

Course Outlines

Option 1—Four One-Carnegie-Unit Courses

This curriculum consists of four one-credit courses, which should be completed in the following sequence:

- 1. Fundamentals of Precision Machining – Course Code: 993405**
- 2. Application of Precision Machining – Course Code: 993406**
- 3. Theory of Precision Machining – Course Code: 993407**
- 4. Advanced Skills of Precision Machining – Course Code: 993408**

Course Description: Fundamentals of Precision Machining

Fundamentals of Precision Machining includes an introduction to the field of precision machining as well as fundamentals of safety, tools, basic math, blueprint reading, and milling machinery.

Course Description: Application of Precision Machining

Application of Precision Machining emphasizes an overview of safety and leadership, lathe theory, and grinding operations. This course gives students hands-on practice in these areas.

Course Description: Theory of Precision Machining

Theory of Precision Machining includes a study of precision machining techniques and advanced lathe operation.

Course Description: Advanced Skills of Precision Machining

Advanced Skills of Precision Machining emphasizes the study of precision machining techniques in advanced milling and CNC operations.

Fundamentals of Precision Machining – Course Code: 993405

Unit	Unit Name	Hours
1	Orientation, Leadership, and Basic Safety	25
2	Math, Measuring Tools, and Instruments	20
3	Introduction to Blueprints and Hand and Power Tools	25
4	Drill Press and Band Saw Theory and Operation	20
5	Milling Machine Theory and Operation	30
Total		120

Application of Precision Machining – Course Code: 993406

Unit	Unit Name	Hours
6	Lathe Theory and Operation	75
7	Bench and Pedestal Grinding (Offhand Grinding)	25
8	Intro to Advanced Lathe and Milling Skills	25
Total		125

Theory of Precision Machining – Course Code: 993407

Unit	Unit Name	Hours
9	Orientation, Advanced Leadership, and Employability Skills	8
10	Basic Safety (Review and Reinforcement)	10
11	Advanced Lathe Operation	95
Total		113

Advanced Skills of Precision Machining – Course Code: 993408

Unit	Unit Name	Hours
12	Advanced Milling Operation	95
13	Grinding Theory and Operation	25
14	Computerized Numerical Control	10
Total		130

Option 2—Two Two-Carnegie-Unit Courses

This curriculum consists of two two-credit courses, which should be completed in the following sequence:

1. **Precision Machining I — Course Code: 993403**
2. **Precision Machining II— Course Code: 993404**

Course Description: Precision Machining I

Precision Machining I includes orientation and leadership, basic safety, math, measuring tools and instruments, blueprints, hand and power tools, lathe theory and operation milling, machine theory and operation, and grinding operations. Safety is emphasized in each unit and every activity.

Course Description: Precision Machining II

Precision Machining II includes advanced precision machining techniques in lathing, vertical milling, and computer numerical control (CNC).

Precision Machining I — Course Code: 993403

Unit	Unit Name	Hours
1	Orientation, Leadership, and Basic Safety	25
2	Math, Measuring Tools, and Instruments	20
3	Introduction to Blueprints and Hand and Power Tools	25
4	Drill Press and Band Saw Theory and Operation	20
5	Milling Machine Theory and Operation	30
6	Lathe Theory and Operation	75
7	Bench and Pedestal Grinding (Offhand Grinding)	25
8	Intro to Advanced Lathe and Milling Skills	25
Total		245

Precision Machining II— Course Code: 993404

Unit	Unit Name	Hours
9	Orientation, Advanced Leadership, and Employability Skills	8
10	Basic Safety (Review and Reinforcement)	10
11	Advanced Lathe Operation	95
12	Advanced Milling Operation	95
13	Grinding Theory and Operation	25
14	Computerized Numerical Control	10
Total		243



Precision Machining

Mississippi Department of Education

2012

Program CIP: 48.0503

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Mississippi State, MS 39762

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Kim DeVries, Editor

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The Mississippi Department of Education, Office of Career and Technical Education does not discriminate on the basis of race, color, religion, national origin, sex, age, or disability in the provision of educational programs and services or employment opportunities and benefits. The following office has been designated to handle inquiries and complaints regarding the non-discrimination policies of the Mississippi Department of Education: Director, Office of Human Resources, Mississippi Department of Education, 359 North West Street, Suite 203, Jackson, Mississippi 39201, 601.359.3511.

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The Precision Machining curriculum was presented to the Mississippi Board of Education on February 16-17, 2012. The following persons were serving on the state board at the time:

Dr. Tom Burnham, State Superintendent
Mr. William Harold Jones, Chair
Mr. Charles McClelland, Vice Chair
Ms. Kami Bumgarner
Mr. Howell "Hal" N. Gage
Dr. O. Wayne Gann
Mr. Claude Hartley
Ms. Martha "Jackie" Murphy
Ms. Rosetta Richards
Dr. Sue Matheson

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Tammy Ates, Hinds Community College
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Andy Sims, SKILLS USA Student Organization Coordinator, Office of Career and Technical Education, Mississippi Department of Education, Jackson, MS

Bill McGrew, Program Coordinator, Office of Career and Technical Education, Mississippi Department of Education, Jackson, MS

Preface

Secondary career and technical education programs in Mississippi are faced with many challenges resulting from sweeping educational reforms at the national and state levels. Schools and teachers are increasingly being held accountable for providing true learning activities to every student in the classroom. This accountability is measured through increased requirements for mastery and attainment of competency as documented through both formative and summative assessments.

The courses in this document reflect the statutory requirements as found in Section 37-3-49, Mississippi Code of 1972, as amended (Section 37-3-46). In addition, this curriculum reflects guidelines imposed by federal and state mandates (Laws, 1988, ch. 487, §14; Laws, 1991, ch. 423, §1; Laws, 1992, ch. 519, §4 eff. from and after July 1, 1992; Carl D. Perkins Vocational Education Act IV, 2007; and No Child Left Behind Act of 2001).

Precision Machining Executive Summary

Pathway Description

The Precision Machining pathway is designed as a secondary program for preparation to enter the field of precision machining and metal turning. The Precision Machining program includes an introduction to the basic machining metalworking processes. The purpose of the course is to prepare students to continue study in a postsecondary metals program (Precision Machining, Machine Tool Operation, and Automotive Machining) or to begin work at the entry level in a machining occupation. The machining courses found in this curriculum were written to the National Institute for Metalworking Skills (NIMS) credentialing standards.

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NIMS metalworking standards reflect expertise in areas such as stamping, press brake, roll forming, machining, tool and die making, mold making, screw machining, and machine maintenance and repair. All NIMS standards are industry written and industry validated and subjected to regular, periodic reviews under the procedures accredited and audited by ANSI.

The NIMS Level 1 credential consists of bench work, layout, milling, drill press, surface grinding, and lathing between centers. The students are required to perform a NIMS approved project in each area in order to attain credentialing in those areas. The student must be able to complete the NIMS project with 100% accuracy before being allowed to take an additional online written test. Once both the performance evaluation and the online test are administered and passed, the student will receive a NIMS certification for each area successfully completed, that is, bench work, layout, milling, drill press, surface grinding, and lathing between centers. The NIMS organization awards credentials for each area of competency in the Level 1 module after successful completion of projects and written tests.

NIMS credentials are used throughout the United States by industry to recruit, hire, place, and promote individual workers. NIMS may also be used to measure performance of individuals pursuing metalworking careers. Articulation may be established using the NIMS credentials for articulation among training programs.

Students who study basic machine metalworking processes may pursue, at their cost, a certification with the National Institute for Metalworking Skills, Inc. (NIMS). Students who study this curriculum may pursue certification of the NIMS Level 1 standards for machining. Attaining this certification is an option for the student; therefore, the student is responsible for the financial costs attributed with achievement of the certification.

Assessment

Students will be assessed using the Precision Machining MS-CPAS2 test. The MS-CPAS2 blueprint can be found at <http://www.rcu.msstate.edu/>. If there are questions regarding assessment of this program, please contact the Manufacturing Cluster Instructional Design Specialists at the Research and Curriculum Unit at 662.325.2510.

Student Prerequisites

In order for students to be successful in the Precision Machining program, the following student prerequisites are in place:

1. ~~C or Higher in English (the previous year)~~
 2. ~~C or Higher in Math~~
 3. ~~Instructor Approval and TABE Reading Score (eighth grade or higher)~~
- OR
4. ~~Instructor Approval~~

Applied Academic Credit (if applicable)

No applied academic credit is available for this pathway at this time.

Licensure Requirements

969 — Career Pathway: Precision Machining

This endorsement licenses a person to teach the following secondary courses:

~~993200 – 2 Manufacturing Fundamentals~~

~~993400 – 2 Precision Machining~~

~~993202 – 1 Manufacturing Fundamentals I~~

~~993203 – 1 Manufacturing Fundamentals II~~

~~993401 – 1 Precision Machining I~~

~~993402 – 1 Precision Machining II~~

Minimum Requirements for this Endorsement:

1. Education

~~–Hold a two-year college degree (associate degree) or higher from an accredited institution of higher education.~~

2. Occupational Experience and Related Assessment of that Experience

~~–Applicants with an associate degree must have at least two years of verifiable occupational experience in the past 10 years. Experience must be appropriate to the subject to be taught.~~

~~–Applicants with a bachelor or higher degree must have at least one year of verifiable occupational experience in the past 10 years. Experience must be appropriate to the subject to be taught.~~

This endorsement requires the following assessment(s) of occupational expertise:

National Institute of Metalworking Skills (NIMS) Level One

OR

Other teacher occupational competency assessment approved by MDE Office of Career and Technical Education.

3. Technology Literacy and Related Assessment of that Competency

—Applicant must validate technology competency by attaining the established minimum score or higher on an assessment approved by the Mississippi Department of Education (MDE). The assessment must be directly related to technology competency required by the grade level and subject matter being taught. Approved assessments for this license are IC3, Propulse, or other specific assessment created by third-party vendors, authorized by the Local Education Agency (LEA), and approved by the MDE.

4. Teacher Education Preparation and Related Assessment(s) of that Education

—Applicant must enroll immediately in Vocational Instructor Preparation (VIP) program.

—Applicant must complete the individualized professional development plan (PDP) requirements of the VIP program prior to the expiration date of the three-year vocational license.

—Applicant must successfully complete a Certification for online learning workshop, module, or course that is approved by the Mississippi Department of Education.

—Applicant must successfully complete the Architecture and Drafting Certification workshop, module, or course that is approved by the Mississippi Department of Education.

note #1: If the applicant meets all requirements listed above, that applicant will be issued a 969 endorsement (a five-year license). If the applicant does not meet all requirements, the applicant may be issued a three-year endorsement (license), and all requirements stated above must be satisfied prior to the ending date of that license.

*Exception: Teachers with a currently valid license and endorsement #359 Machine Shop or #361 Metal Trades may earn this endorsement based on that #359 or #361 endorsement even if a two-year college degree is not earned. All other requirements for this endorsement must be satisfied.

Professional Learning

The professional learning itinerary for the middle-school or individual pathways can be found at <http://redesign.rcu.msstate.edu>. If you have specific questions about the content of each training session provided, please contact the Research and Curriculum Unit (RCU) at 662.325.2510, and ask for the Professional Learning Specialist.

Course Outlines

~~Option 1—Four One Carnegie Unit Courses~~

Upon completion of this option, the student will be trained to take the NIMS Level 1 Certification exams (CNC Milling and CNC Lathing certifications are dependent upon local school resources). This curriculum consists of four one-credit courses, which should be completed in the following sequence:

- ~~• Scheduling and operating more than one course in the same classroom/laboratory with the same teacher is not allowed.~~
- ~~• Safety will be reinforced and tested at the beginning of each course.~~
- ~~• Students must complete Metal Fabrication courses with a score of 80/C or higher in class work to advance to the next level.~~

~~Course Description: 1.— Manufacturing Machining I (Course Code: 993202)~~

~~Manufacturing Machining I (Course Code: 993202) includes an introduction to the field as well as fundamentals of safety, tools, math, blueprint reading, and milling machinery. This is a one-Carnegie-unit course.~~

~~Course Description: 2.— Manufacturing Machining II (Course Code: 993203)~~

~~Manufacturing Machining II (Course Code: 993203) emphasizes an overview of safety and leadership, the lathe theory, and grinding operations. This course gives student's real-world, hands-on practice in these areas. This one-Carnegie-unit course should only be taken after students successfully pass Manufacturing Machining I.~~

~~Course Description: 3.— Precision Machining I (Course Code: 993401)~~

~~Precision Machining I (Course Code: 993204) includes a study of precision machining techniques in advanced lathe operation. This one-Carnegie-unit course should only be taken after students successfully pass Manufacturing Machining II.~~

~~Course Description: 4.— Precision Machining II (Course Code: 993402)~~

~~Precision Machining II (Course Code: 993205) includes a study of precision machining techniques in advanced milling and CNC operation. This one-Carnegie-unit course should only be taken after students successfully pass Precision Machining I.~~

Manufacturing Machining I — Course Code: 993202

Unit Number	Unit Name	Hours
1	Orientation, Leadership, and Basic Safety	15
2	Math, Measuring Tools, and Instruments	20
3	Introduction to Blueprints and Hand and Power Tools	25
4	Drill Press and Band Saw Theory and Operation	20
5	Milling Machine Theory and Operation	30
Total		110

Manufacturing Machining II — Course Code: 993203

Unit Number	Unit Name	Hours
8	Orientation, Advanced Leadership, and Employability Skills	5
9	Basic Safety (Review and Reinforcement)	5
4	Lathe Theory and Operation	75
6	Grinding Theory and Operation	25
Total		110

Precision Machining I — Course Code: 993401

Unit Number	Unit Name	Hours
7	Orientation, Advanced Leadership, and Employability Skills	5
8	Basic Safety (Review and Reinforcement)	15
10	Advanced Lathe Operation	95
Total		115

Precision Machining II — Course Code: 993402

Unit Number	Unit Name	Hours
7	Orientation, Advanced Leadership, and Employability Skills	5
8	Basic Safety (Review and Reinforcement)	10
11	Advanced Milling Operation	95
12	Computerized Numerical Control	10
Total		120

Note: CNC Milling and CNC Lathing course content are dependent upon local school resources

Option 2 — Two Two Carnegie Unit Courses

This curriculum consists of two two Carnegie unit courses.

- Scheduling and operating more than one course in the same classroom/laboratory with the same teacher is not allowed.
- Safety will be reinforced and tested at the beginning of each course.
- Students must complete Metal Fabrication courses with a score of 80/C or higher in class work to advance to the next level.

Course Description: Manufacturing Fundamentals (Course Code: 993200)

Manufacturing Fundamentals I content includes orientation and leadership; basic safety; math, measuring tools, and instruments; blueprints; hand and power tools; lathe theory and operation; milling machine theory and operation; and grinding operations. Safety is emphasized in each unit and every activity.

Course Description: Precision Machining (Course Code: 993400)

Precision Machining includes advanced precision machining techniques in lathing, vertical milling and Computer Numerical Control (CNC). (CNC course content depth is dependent upon local school resources)

Manufacturing Fundamentals — Course Code: 993200

Unit Number	Unit Name	Hours
1	Orientation, Leadership, and Basic Safety	25
2	Math, Measuring Tools, and Instruments	20
3	Introduction to Blueprints and Hand and Power Tools	25
4	Drill Press and Band Saw Theory and Operation	20
5	Milling Machine Theory and Operation	30
6	Lathe Theory and Operation	75
7	Grinding Theory and Operation	25
Total		220

Precision Machining — Course Code: 993400

Unit Number	Unit Name	Hours
8	Orientation, Advanced Leadership, and Employability Skills	10
9	Basic Safety (Review and Reinforcement)	10
10	Advanced Lathe Operation	95
11	Advanced Milling Operation	95
12	Computerized Numerical Control	10
Total		220