

Manufacturing Technology III

GRADE 11

June 2014

I. COURSE DESCRIPTION

Manufacturing Technology III is a full year study designed as a course to continue skills learned from Manufacturing II. This third year course is a continuation of knowledge obtained from identifying and understanding various related equipment and by producing custom made entities. The course continues to prepare the student for post high school training or entry level employment in the Machining Industry. This third year course reinforces basic machine shop equipment. Basic controls and applications of drill presses and milling machines are covered including the basic operations of related equipment. Maintenance of related equipment and lubrication techniques are covered.

Students will develop their existing Core Skill Set within a manufacturing environment. By studying all of the aspects of the shop, students will not only prepare themselves for industry exams, but they will gain a competitive edge in the Machining industry. Quality Control and Electromachining aspects are introduced. Computer Aided Design and Computer Aided Manufacturing is introduced.

Computer Numerical Control equipment, CNC, is introduced. The history of CNC equipment is discussed. The overall capabilities of CNC equipment is identified. Students will learn coordinate systems, basic programming and the aspects of CNC milling and turning.

Students of the Manufacturing Technology III will add to their existing skill set and obtain additional machine skills. Related shop safety is reinforced. Students will reinforce their skills in the using Mastercam for the design of various projects. The student will also continue in their proficiency in speaking the correct vernacular, as well as how to perform in a professional machine shop setting.

II. COURSE OBJECTIVES/OUTLINE

Grade 11

- I. Careers in Machining Technology
 - A. Job Categories
 - B. Job Preparation
 - C. Keeping Skills Current
- II. Safety
 - A. Shop
 - B. OSHA Guidelines
 - C. Personal Protective Equipment
 - D. Guards and Barriers
 - E. Handling and Lifting
 - F. Compressed Air
 - G. Lockout and Tagout
 - H. Hazardous Materials
 - I. Fire Safety
 - J. CNC Safety
- III. Hand Tools
 - A. Basic Operation and Use
 - B. Hand Threading
 - C. Hand Polishing
- X. Saws
 - A. Basic Operation and Use
 - B. Maintenance of Saws
- IV. Drills and Drilling Machines
 - A. Basic Operation and Use
 - B. Sharpening Drills
 - C. Drilling, Countersinking and Counterboring
 - D. Spotfacing, Tapping, Reaming and Microdrilling
- V. Grinding
 - A. Basic Operation and Use
 - B. Universal Tool and Cutter Grinder
 - C. Sharpening Cutters
 - D. Cylindrical Grinding
 - E. Internal Grinding
 - F. Centerless and Form Grinding
- VI. Lathe
 - A. Basic Operation and Use
 - B. Reaming and Knurling
 - C. Filing and Polishing
 - D. Mandrels
 - E. Grinding and Milling on Lathe

- VII. Milling Machine
 - A. Basic Operation and Use
 - B. Horizontal Milling Machine
 - C. Cutting a Spur Gear
 - D. Cutting a Bevel Gear
 - E. Thread Milling
 - F. High-Velocity Machining
- VIII. CNC
 - A. History of CNC
 - B. Advantages and Disadvantages of Using CNC
 - C. CNC Milling
 - D. CNC Turning
 - E. CNC Coordinate Systems
 - F. CNC Movement Systems
 - G. Developing CNC Programs
 - H. Programming Methods
 - I. CNC Programming Codes
 - J. CNC Modal Commands
- IX. Quality Control
 - A. History of Quality Control
 - B. Types of Quality Control
 - C. Nondestructive Testing Techniques
- X. Heat Treatment of Metal
 - A. Heat-Treatable Metals
 - B. Types of Heat Treatment
 - C. Heat-Treatment Equipment
 - D. Hardening and Tempering of Carbon Steel
 - E. Case Hardening Low-Carbon Steel
 - F. Hardness Testing
- XI. Finishing
 - A. Quality of Machined Surfaces
 - B. Finishing Techniques
- XII. Electromachining
 - A. Electrical Discharge Machining (EDM)
 - B. Electrochemical Machining (ECM)
- XIII. Nontraditional Machining
 - A. Chemical Machining
 - B. Hydrodynamic Machining (HDM)
 - C. Ultrasonic Machining
 - D. Electron-Beam Machining (EBM)
 - E. Laser Beam Machining
- XIV. Other Processes
 - A. Plastics
 - B. Chipless Machining
 - C. Powder Metallurgy

- XV. Metrology
 - A. Drawing Standards
 - B. Welding Symbols
 - C. Dimensioning and Tolerancing
 - D. Dimensioning and Tolerancing Symbols
 - E. Applications and Calculation Methods
 - F. Material Selection
 - G. Equipment Selection and Operation Sequence
- XVI. Mastercam
 - A. Post Processors – Creating G-Code
 - B. Create Part Model and Program for Manufacture
 - C. Create Tool sheet
 - D. Machine the part complete to validate programming
 - E. Edit Mastercam File to match finished part
 - F. Mill – 3Axis
 - G. Importing – Files, Models, Layers
 - H. Set-up and Prove-out Program
- XVII. Computer Aided Design/ Computer Aided Manufacturing
 - A. CAD Software Use
 - B. CAM Software Use

A. THE PATH OF THE MANUFACTURING EQUIPMENT OPERATOR

The student will be able to:

1. Continue development in becoming a machine professional.
2. Recognize the importance of safety throughout the shop environment.
3. Understand the Quality Assurance process.
4. Understand metal composition and classification.
5. Demonstrate the heat treatment of metals.
6. Demonstrate maintenance and lubrication.
7. Understand drawings and measurement systems
8. Understand layouts.
9. Demonstrate the use of Saws and Cutoff Machines
10. Demonstrate the use of Drilling Machines and Saws
11. Understand the aspects of Grinding
12. Demonstrate the use of a Lathe
13. Demonstrate the use of a Band Machine
14. Demonstrate the use of Milling Machine
15. Understand various Metal Characteristics
16. Understand various aspects and components of CNC Machines
17. Demonstrate the use of Mastercam.

New Jersey Core Curriculum Content Standards

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| 9.1.4.A.2 | Evaluate available resources that can assist in solving problems. |
| 9.1.8.A.4 | Design and implement a project management plan using one or more problem-solving strategies. |
| 9.1.4.D.3 | Demonstrate an awareness of one's own culture and other cultures during interactions within and outside of the classroom. |
| 9.1.4.F.3 | Explain the importance of understanding and following rules in family, classroom, and community settings. |
| 9.2.4.A.1 | Explain the difference between a career and a job, and identify various jobs in the community and the related earnings. |
| 9.3.4.A.4 | Identify qualifications needed to pursue traditional and nontraditional careers and occupations. |
| 9.3.4.A.5 | Locate career information using a variety of resources. |
| 9.4.12.B.(1).1 | Demonstrate communication skills and strategies that are used to work effectively with potential clients and others |
| 9.4.12.A.(3).1 | Recognize and employ universal construction signs and symbols to function safely. |
| 9.4.12.A.(3).2 | Use troubleshooting procedures when solving a maintenance problem to maintain project. |
| 9.4.12C.19 | Employ technological tools to expedite workflow. |
| 9.4.12C.36 | Demonstrate knowledge of personal and jobsite safety rules and regulations to maintain safe and healthful working conditions and environments. |
| 9.4.12C.37 | Demonstrate knowledge of employee rights and responsibilities and employers' obligations to maintain workplace safety and health. |

- 9.4.12.M.8 Use correct grammar, punctuation, and terminology to write and edit documents.
- 9.4.12.M.39 Maintain safe and healthful working conditions and environments to ensure employee safety.
- 9.4.12.M.30 Describe and use quality control systems and practices to ensure quality products and services.
- 9.4.12.M.32 Analyze and summarize how manufacturing businesses improve performance to demonstrate an understanding of various methods for enhancing production.
- 9.4.12.M.44 Employ leadership skills to accomplish goals and objectives.
- 9.4.12.M.46 Employ teamwork skills to achieve collective goals and use team members' talents effectively.
- 9.4.12.M.50 Apply ethical reasoning to a variety of situations in order to make ethical decisions.
- 9.4.12.M.52 Identify and demonstrate positive work behaviors and personal qualities needed to succeed in the classroom and/or to be employable.
- 9.4.12.M.53 Develop a Personalized Student Learning Plan to meet career goals and objectives.
- 9.4.12.M.54 Demonstrate skills related to seeking and applying for employment in a desired job.
- 9.4.12.M.55 Maintain a career portfolio to document knowledge, skills, and experience in a career field.
- 9.4.12.M.56 Demonstrate skills in evaluating and comparing employment opportunities in order to accept employment positions that match career goals.
- 9.4.12.M.57 Identify and exhibit traits for retaining employment.
- 9.4.12.M.58 Identify and explore careers in one or more career pathways to build an understanding of the opportunities available in the cluster.
- 9.4.12.M.(1).2 Research new manufacturing processes to manage production of new and/or improved products.
- 9.4.12.M.(1).3 Develop quality improvement processes to maintain quality during the manufacturing production process.
- 9.4.12.M.(1).4 Develop a continuous improvement plan to ensure production of high quality products that meet customer expectations.
- 9.4.12.M.(2).1 Demonstrate how to communicate with others to ensure production meets business requirements.
- 9.4.12.M.(2).9 Design a product that satisfies a customer's desires to demonstrate the relationship between production processes and meeting customer needs.
- 9.4.12.M.(3).5 Develop hands-on knowledge of equipment operation to identify maintenance needs and maximize performance.
- 9.4.12.M.(3).6 Analyze and select installation, customization, or upgrade techniques in order to ensure the proper functioning of manufacturing equipment.
- 9.4.12.M.(3).7 Create a preventive maintenance schedule to maintain manufacturing equipment, tools, and workstations.
- 9.4.12.M.(3).8 Describe predictive and preventive maintenance strategies used to ensure that production processes run smoothly.
- 9.4.12.M.(3).9 Identify and diagnose equipment problems in order to effectively repair manufacturing equipment.

- 9.4.12.M.(4).2 Analyze and select strategies for coordinating work teams to produce a product that meets quality assurance standards.
- 9.4.12.M.(4).3 Evaluate production operations for product and process quality to maintain quality assurance.
- 9.4.12.M.(4).4 Demonstrate understanding of ways to enhance product and process to meet quality standards.
- 9.4.12.M.(4).5 Develop continuous improvement activities for use in the manufacturing environment to enhance the quality of products or processes.
- 9.4.12.M.(4).6 Employ processes, data, and tools to produce a product that satisfies customer needs for quality, value-added products.
- 9.4.12.M.(4).7 Analyze and select continuous improvement processes to maintain quality products and processes.
- 9.4.12.M.(4).8 Inspect manufacturing materials, report quality issues, and release only manufacturing materials that meet quality specifications.
- 9.4.12.N.74 Employ information management techniques and strategies to assist in decision-making.
- 9.4.12.N.75 Employ planning and time management skills and tools to enhance results and complete work tasks.
- 9.4.12.N.76 Understand tools and strategies used to access, process, maintain, evaluate, and disseminate marketing information to assist with business decision-making.

III. METHODS OF STUDENT EVALUATION

Students are evaluated using the following criteria:

1. Class participation
2. Periodic quizzes and tests
3. Shop work
4. Shop Projects
5. Notebook
6. Finished Products

IV. TEXTBOOKS AND INSTRUCTIONAL MATERIALS

Precision Machining Technology, Peter J, Hoffman, Eric Hopewell, Brian Janes, Kent Sharp.Jr. Delmar Cengage Learning, United States 2012 ISBN: 13 978-1-4354-4767-7

Machining Fundamentals, Ninth Edition, John R. Walker and Bob Dixon, The Goodheart-Willcox Company, Inc. Tinley Park, IL. 2004 ISBN: 978-1-61960-209-0

Machining Fundamentals, Workbook, John R. Walker. The Goodheart-Willcox Company, Inc. Tinley Park, IL. 2014 ISBN: 978-1-61960-214-4

Mastercam, CNC Software, Inc., Tolland, Connecticut

V. INSTRUCTIONAL STRATEGIES

Various teaching methods are used in this course. Classroom instruction will be given using prepared worksheets, class notes, instructional videos, and textbook exercises. Hands-on demonstrations, Direct Instruction, Independent Practice and Small-Group Instruction will be the primary teaching methods. Computer instruction will include demonstrations, examples and independent practice. Linking prior knowledge and skills will enable students to demonstrate their variety of skills in all aspects of a typical production machine shop.

VI. SCOPE AND SEQUENCE CHART

KEY: I = INTRODUCED D = DEVELOPED IN DEPTH R = REINFORCED

Grade 11

I.	Careers in Machining Technology		D	R
II.	Safety		D	R
III.	Hand Tools		D	R
IV.	Drills and Drilling Machines		D	R
V.	Grinding		D	R
VI.	Lathe		D	R
VII.	Milling Machine		D	R
VIII.	CNC	I	D	R
IX.	Quality Control	I	D	
X.	Heat Treatment of Metal		D	
XI.	Finishing		D	R
XII.	Electromachining	I	D	
XIII.	Nontraditional Machining	I	D	
XIV.	Other Processes	I	D	
XV.	Metrology		D	R
XVI.	Mastercam		D	R
XVII.	Computer Aided Design/Computer Aided Manufacturing	I	D	R

VII. PACING CHART

I.	Careers in Machining Technology	Week 1
II.	Safety	Week 2 - 3
III.	Hand Tools	Week 3
IV.	Drills and Drilling Machines	Week 4
V.	Grinding	Week 5
VI.	Lathe	Week 6
VII.	Milling Machine	Week 7
VIII.	CNC	Week 8 - 11
IX.	Quality Control	Week 12 -14
X.	Heat Treatment of Metal	Week 15 - 17
XI.	Finishing	Week 18 - 19
XII.	Electromachining	Week 20- 22
XIII.	Nontraditional Machining	Week 23- 25
XIV.	Other Processes	Week 26 - 27
XV.	Metrology	Week 28 - 32
XVI.	Mastercam	Week 33 - 34
XVII.	Computer Aided Design/Computer Aided Manufacturing	Week 35 - 36

VIII. STUDENT HANDOUT

COURSE OVERVIEW

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PROFICIENCIES

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