Florida Department of Education
Curriculum Framework

Program Title: **Industrial Machinery Maintenance 2**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program		
Program Number	J590200	
CIP Number	0647030304	
Grade Level	30, 31	
Program Length	600 hours	
Teacher Certification	Refer to the **Program Structure** section	
CTSO	SkillsUSA	
SOC Codes (all applicable)	For program SOC codes, please see the Program and Course Tables section of the CTE Program Resources page linked below.	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 9	Communications (Reading and Language Arts): 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster. This program offers a broad foundation of knowledge and skills to prepare students for employment in industrial-machinery maintenance positions.

The content includes but is not limited to understanding all aspects of the industrial-machinery maintenance-technology industry, and demonstrates elements of the industry such as planning, management, finance, technical and production skills, underlying principles of technology, labor issues, community issues, and health, safety, and environmental issues.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of two occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

The standard length for this program is 600 hours. **Industrial Machinery Maintenance 1** is a core program. It is recommended students complete **Industrial Machinery Maintenance 1,** or demonstrate mastery of the outcomes in that program, prior to enrollment in **Industrial Machinery Maintenance 2.**

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	ETI0457	Machinery Maintenance Technician	BLDG CONST @7 7G IND ENGR 7G MACH SHOP @7 7G MILLWRIGHT 7G TEC CONSTR @7 7G	150 hours
B	ETI0458	Industrial Maintenance Specialist		450 hours

Florida's Career Readiness Skills for CTE Programs

Employability Skills	
01.0	Apply academic skills to workplace scenarios.
01.01	Use reading skills.
01.02	Use writing skills.
01.03	Use mathematical strategies and procedures.
01.04	Use scientific principles and procedures.
02.0	Design a solution to an industry problem.
02.01	Use critical thinking.
02.02	Use creativity.
02.03	Make sound decisions.
02.04	Solve problems.
02.05	Reason.
02.06	Plan and organize.
03.0	Manage resources within an industry project
03.01	Manage time.
03.02	Manage money or resources.
03.03	Manage materials.
03.04	Manage personnel.
04.0	Oversee the subcomponents, operations and output of a technical or organizational system.
04.01	Manage systems.
04.02	Monitor systems.
04.03	Improve systems.
05.0	Use information for decision making.
05.01	Locate information.
05.02	Organize information.
05.03	Use information.

	05.04 Analyze information.
	05.05 Communicate information.
06.0	Apply relevant technology to workplace scenarios to aid productivity.
	06.01 Use technology.
07.0	Interpret and express interpersonal communication.
	07.01 Communicate verbally.
	07.02 Listen actively.
	07.03 Comprehend written material.
	07.04 Convey information in writing.
	07.05 Communicate nonverbally.
	07.06 Interpret nonverbal communication.
08.0	Interact with others to accomplish workplace goals.
	08.01 Collaborate with others in a team.
	08.02 Respond to customer needs.
	08.03 Exercise leadership.
	08.04 Negotiate to resolve conflict.
	08.05 Respect others.
09.0	Manage personal behavior to maximize productivity and professional growth.
	09.01 Demonstrate responsibility and self-discipline.
	09.02 Adapt and show flexibility.
	09.03 Work independently.
	09.04 Demonstrate a willingness to learn.
	09.05 Demonstrate integrity.
	09.06 Demonstrate professionalism.
	09.07 Take initiative.
	09.08 Display positive attitude.
	09.09 Take responsibility for professional growth.

Job Attainment	
10.0	Find, assess and apply to job opportunities.
10.01	Identify online job posts relevant to his or her career aspirations.
10.02	Compare and contrast the job posts' required qualifications, job duties, compensation, benefits and employers.
10.03	Define what information, documentation and writing prompts are required for the positions.
11.0	Communicate personal competence, character and fit for a job opportunity.
11.01	Develop a resume.
11.02	Write a cover letter.
11.03	Curate a professional portfolio that includes work products.
11.04	Prepare for and experience a mock job interview.
12.0	Cultivate and leverage relationships to professionally advance.
12.01	Request a signed reference letter, letter of recommendation and/or an online skill/professionalism endorsement.
12.02	Develop a plan to cultivate a professional digital footprint.
12.03	Develop a networking plan for a specific industry of interest.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Plan an elementary predictive-preventive-maintenance (PPM) schedule.
02.0 Maintain and repair hydraulic-system components.
03.0 Troubleshoot hydraulic systems.
04.0 Maintain and troubleshoot robotic systems.
05.0 Demonstrate an understanding of employability skills and career opportunities.

Industrial Maintenance Specialist
06.0 Prepare for machinery startup.
07.0 Apply vibration-analysis skills.
08.0 Perform machinery balancing.
09.0 Demonstrate predictive-preventive-maintenance (PPM) technologies.
10.0 Use computer-maintenance-management systems (CMMS).
11.0 Perform failure analysis (FA).
12.0 Improve rotating equipment performance.
13.0 Generate machine improvements and maintenance management.

Florida Department of Education
Student Performance Standards

Program Title: **Industrial Machinery Maintenance 2**
Career Certificate Program Number: **J590200**

Course Description: The Machinery Maintenance Technician course prepares students for entry into the Industrial Machinery Maintenance and Repair industry. Content emphasizes beginning skills and concepts as a recommended requisite. Students study elementary predictive-preventive-maintenance planning, maintain and troubleshoot hydraulic and robotic systems, and understanding employability skills.

Course Number: ETI0457 **Occupational Completion Point: A** **Machinery Maintenance Technician – 150 Hours**	
01.0	Plan an elementary predictive-preventive-maintenance (PPM) schedule. The student will be able to:
01.01	List the types of predictive-preventive maintenance.
01.02	Describe the purpose of preventive-maintenance schedules.
01.03	Create a preventive-maintenance schedule form using a machine manual or the manufacturer recommendations.
01.04	Identify troubles caused by the lack of preventive maintenance.
01.05	Create a maintenance log and make entries for a machine or equipment.
01.06	Create a preventive-maintenance schedule from a maintenance-failures log.
02.0	Maintain and repair hydraulic-system components. The student will be able to:
02.01	Explain the safety procedures for installing hydraulic lines.
02.02	Explain how heat and pressure relate to power and transmission.
02.03	Describe the physical and chemical properties of a fluid.
02.04	Install and maintain a contaminant-removal system.
02.05	Determine reservoir requirements.
02.06	Classify and select pumps for specific applications.
02.07	Compute hose requirements.
02.08	Select and install control valves.
03.0	Troubleshoot hydraulic systems. The student will be able to:
03.01	Explain the safety procedures for troubleshooting hydraulic systems.

	03.02 Read a hydraulic schematic.
	03.03 Install hydraulic components.
	03.04 Connect electrically controlled valves.
	03.05 Explain hydraulic system troubleshooting techniques.
	03.06 Repair and replace valves.
	03.07 Repair and replace cylinders.
	03.08 Repair and replace pumps and motors.
04.0	Maintain and troubleshoot robotic systems. The student will be able to:
	04.01 Identify uses of robotics in industry.
	04.02 Identify safety procedures related to robotic systems.
	04.03 Identify mechanical, hydraulic, pneumatic, and electric/electronic components of robotic systems.
05.0	Demonstrate an understanding of employability skills and career opportunities. The student will be able to:
	05.01 Demonstrate knowledge of good workplace behavior and how to address improper workplace behavior.
	05.02 Discuss motivation and human behavior.
	05.03 Demonstrate knowledge of ways to improve reading, listening, and writing skills.
	05.04 Provide effective feedback and make suggestions.
	05.05 Demonstrate knowledge of roles and responsibilities of team members.
	05.06 Effectively communicate production and process information to internal and external customers.
	05.07 Develop personal career plan that includes goals, objectives, and strategies.
	05.08 Examine licensing, certification, and industry credentialing requirements.
	05.09 Evaluate and compare employment opportunities that match career goals.
	05.10 Identify and exhibit traits for retaining employment.
	05.11 Identify opportunities and research requirements for career advancement.
	05.12 Research the benefits of ongoing professional development.

Course Description: The Industrial Maintenance Specialist course is designed to build on the skills and knowledge students learned in the Machinery Maintenance Technician course for entry into the Industrial Machinery Maintenance and Repair industry. Students explore career opportunities and requirements of a professional industrial machinery mechanic. Students study machinery startup, vibration analysis, machinery

balancing, predictive-preventative maintenance, computer maintenance management systems, failure analysis, rotating equipment, and machine improvement.

Course Number: ETI0458 Occupational Completion Point: B Industrial Maintenance Specialist – 450 Hours	
06.0	Prepare for machinery startup. The student will be able to:
06.01	Describe the requirements and precautions for machinery startup.
06.02	Align machinery using wire line, transit, dial indicators, a computer, and laser-alignment devices.
06.03	Position and secure machinery on a foundation.
06.04	Level machinery and install balance-vibration dampeners.
06.05	Identify pipe-stress standards for machine-maintenance applications.
06.06	Perform finish alignment and check for pipe stresses in machinery- maintenance applications.
07.0	Apply vibration-analysis skills. The student will be able to:
07.01	Collect vibration data.
07.02	Interpret vibration data.
07.03	Determine velocity, acceleration, spike energy, frequency, amplitude, and other vibration sources.
07.04	Describe the safety requirements and precautions for vibration analysis.
07.05	Operate and use vibration software.
07.06	Predict and verify the condition of machinery in an industrial setting using vibration tools.
07.07	Explain the approximately 25 sources of vibration.
07.08	Explain the bearing frequency (BIFO) formulas.
07.09	Demonstrate proficiency in vibration detection.
08.0	Perform machinery balancing. The student will be able to:
08.01	Describe the safety requirements and precautions for balancing procedures and equipment.
08.02	Identify the principles of static balancing.
08.03	Perform a vector balance in the classroom.
08.04	Identify balancing standards, ISO 1940 or equal.
08.05	Perform a stand balance in a shop.

	08.06 Perform a field balance in an industrial setting.
	08.07 Use portable or stationary balancing equipment.
09.0	Demonstrate predictive-preventive-maintenance (PPM) technologies. The student will be able to:
	09.01 Explain the use of infrared thermography.
	09.02 Explain the use of ultrasound technology.
	09.03 Explain the use of advanced alignment techniques (optical and Essinger bars).
	09.04 Explain the use of oil ferrography and the types of oil sampling.
	09.05 Explain the use of shock pulse equipment.
	09.06 Describe the safety requirements for PPM technologies.
	09.07 Demonstrate the use of one of the above predictive-maintenance procedures.
	09.08 Plan an advanced PPM schedule.
10.0	Use computer-maintenance-management systems (CMMS). The student will be able to:
	10.01 Operate CMMS software.
	10.02 Enter and close a maintenance work order with CMMS.
	10.03 Schedule a series of maintenance tasks.
	10.04 Write a detailed maintenance job plan.
	10.05 Order parts and supplies for a maintenance work order.
	10.06 Determine the personnel resources needed for a maintenance job.
11.0	Perform failure analysis (FA). The student will be able to:
	11.01 Conduct/lead a failure analysis meeting to determine the root cause of a failure.
	11.02 Create a failure-analysis form and write a minimum of two different types of failure-analysis reports.
	11.03 Explain the types of bearing failures.
	11.04 Explain the types of shaft fatigues and failures.
	11.05 Explain the types of lubrication breakdowns.
	11.06 Estimate the cost and the impact on production of a specific failure.
12.0	Improve rotating-equipment performance. The student will be able to:
	12.01 Calculate shaft-deflection ratios and use the results to improve shaft design.

12.02	Draw or sketch equipment bases and supports of sturdy construction.
12.03	Demonstrate and install advanced labyrinth-sealing devices.
12.04	Demonstrate and install advanced mechanical-sealing devices.
12.05	Run the Gates Belts or another interactive belt-design-and- tensioning computer program applied to various drives.
12.06	Explain the benefits of synthetic oils and greases.
12.07	Explain MTBF (mean time between equipment failure) and its cost impact when machinery life is extended.
12.08	List seven specific machinery-improvement ideas in detail.
13.0	Generate machine improvements and maintenance management. The student will be able to:
13.01	Review and critique machinery and base design for improvement before the equipment is placed on order.
13.02	Identify the essential elements of effective maintenance management:
	• Reward system
	• Predictive-preventive maintenance
	• Planning
	• Work-order systems
	• Organizations
	• Goals and tracking
	• Facilities
	• Storerooms
	• Contractors
	• Shutdowns
13.03	Write a report on the design and effective use of at least two of the essential elements of management.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

CTSOs are co-curricular career and technical student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered. Other CTSOs not listed in this curriculum framework or recognized by the Florida Department of Education are permissible provided they support student mastery over the standards and benchmarks of this curriculum framework.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Computation (Mathematics) and Communications (Reading and Language Arts). These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02, Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91, F.S.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as

instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.