Manufacturing Career Cluster
Robotics and Automated Systems
Course Number: 21.44500

COURSE DESCRIPTION:
Upon completing this course, students will be able to apply their knowledge of computer aided design (CAD), computer numerical control (CNC), robotics, computer assisted manufacturing (CAM), programmable logic controllers (PLC), automated guided vehicles (AGV), and computer integrated manufacturing (CIM).

Course Standard 1

MAN-RAS-1
The following standard is included in all CTAE courses adopted for the Career Cluster/Pathways. Teachers should incorporate the elements of this standard into lesson plans during the course. The topics listed for each element of the standard may be addressed in differentiated instruction matching the content of each course. These elements may also be addressed with specific lessons from a variety of resources. This content is not to be treated as a unit or separate body of knowledge but rather integrated into class activities as applications of the concept.

Standard: Demonstrate employability skills required by business and industry.
The following elements should be integrated throughout the content of this course.

1.1 Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities.

Person-to-Person Etiquette	Telephone and Email Etiquette	Cell Phone and Internet Etiquette	Communicating At Work	Listening
Interacting with Your Boss	Telephone Conversations	Using Blogs	Improving Communication Skills	Reasons, Benefits, and Barriers
Interacting with Subordinates	Barriers to Phone conversations	Using Social Media	Effective Oral Communication	Listening Strategies
Interacting with Co-workers	Making and Returning Calls		Effective Written Communication	Ways We Filter What We Hear
Interacting with Suppliers	Making Cold Calls		Effective Nonverbal Skills	Developing a Listening Attitude
	Handling Conference Calls		Effective Word Use	Show You Are Listening
	Handling Unsolicited Calls		Giving and Receiving Feedback	Asking Questions
				Obtaining Feedback
				Getting Others to Listen

Nonverbal Communication	Written Communication	Speaking	Applications and Effective Résumés
Communicating Nonverbally	Writing Documents	Using Language Carefully	Completing a Job Application
Reading Body Language and mixed Messages	Constructive Criticism in Writing	One-on-One Conversations	Writing a Cover Letter
Matching Verbal and Nonverbal communication		Small Group Communication	Things to Include in a Résumé
Improving Nonverbal Indicators		Large Group Communication	Selling Yourself in a Résumé
Nonverbal Feedback		Making Speeches	Terms to Use in a Résumé

Showing Confidence Nonverbally		Involving the Audience	Describing Your Job Strengths
Showing Assertiveness		Answering Questions	Organizing Your Résumé
		Visual and Media Aids	Writing an Electronic Résumé
		Errors in Presentation	Dressing Up Your Résumé

1.2 Demonstrate creativity by asking challenging questions and applying innovative procedures and methods.

Teamwork and Problem Solving	Meeting Etiquette
Thinking Creatively	Preparation and Participation in Meetings
Taking Risks	Conducting Two-Person or Large Group Meetings
Building Team Communication	Inviting and Introducing Speakers
	Facilitating Discussions and Closing
	Preparing Visual Aids
	Virtual Meetings

1.3 Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations.

Problem Solving	Customer Service	The Application Process	Interviewing Skills	Finding the Right Job
Transferable Job Skills	Gaining Trust and Interacting with Customers	Providing Information, Accuracy and Double Checking	Preparing for an Interview	Locating Jobs and Networking
Becoming a Problem Solver	Learning and Giving Customers What They Want	Online Application Process	Questions to Ask in an Interview	Job Shopping Online
Identifying a Problem	Keeping Customers Coming Back	Following Up After Submitting an Application	Things to Include in a Career Portfolio	Job Search Websites
Becoming a Critical Thinker	Seeing the Customer's Point	Effective Résumés:	Traits Employers are Seeking	Participation in Job Fairs
Managing	Selling Yourself and the Company	Matching Your Talents to a Job	Considerations Before Taking a Job	Searching the Classified Ads
	Handling Customer Complaints	When a Résumé Should be Used		Using Employment Agencies
	Strategies for Customer Service			Landing an Internship
				Staying Motivated to Search

1.4 Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity.

Workplace Ethics	Personal Characteristics	Employer Expectations	Business Etiquette	Communicating at Work
Demonstrating Good Work Ethic	Demonstrating a Good Attitude	Behaviors Employers Expect	Language and Behavior	Handling Anger
Behaving Appropriately	Gaining and Showing Respect	Objectionable Behaviors	Keeping Information Confidential	Dealing with Difficult Coworkers
Maintaining Honesty	Demonstrating Responsibility	Establishing Credibility	Avoiding Gossip	Dealing with a Difficult Boss
Playing Fair	Showing Dependability	Demonstrating Your Skills	Appropriate Work Email	Dealing with Difficult Customers
Using Ethical Language	Being Courteous	Building Work Relationships	Cell Phone Etiquette	Dealing with Conflict
Showing Responsibility	Gaining Coworkers' Trust		Appropriate Work Texting	

Reducing Harassment	Persevering		Understanding Copyright	
Respecting Diversity	Handling Criticism		Social Networking	
Making Truthfulness a Habit	Showing Professionalism			
Leaving a Job Ethically				

1.5 Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills.

Expected Work Traits	Teamwork	Time Management
Demonstrating Responsibility	Teamwork Skills	Managing Time
Dealing with Information Overload	Reasons Companies Use Teams	Putting First Things First
Transferable Job Skills	Decisions Teams Make	Juggling Many Priorities
Managing Change	Team Responsibilities	Overcoming Procrastination
Adopting a New Technology	Problems That Affect Teams	Organizing Workspace and Tasks
	Expressing Yourself on a Team	Staying Organized
	Giving and Receiving Constructive Criticism	Finding More Time
		Managing Projects
		Prioritizing Personal and Work Life

1.6 Present a professional image through appearance, behavior and language.

On-the-Job Etiquette	Person-to-Person Etiquette	Communication Etiquette	Presenting Yourself
Using Professional Manners	Meeting Business Acquaintances	Creating a Good Impression	Looking Professional
Introducing People	Meeting People for the First Time	Keeping Phone Calls Professional	Dressing for Success
Appropriate Dress	Showing Politeness	Proper Use of Work Email	Showing a Professional Attitude
Business Meal Functions		Proper Use of Cell Phone	Using Good Posture
Behavior at Work Parties		Proper Use in Texting	Presenting Yourself to Associates
Behavior at Conventions			Accepting Criticism
International Etiquette			Demonstrating Leadership
Cross-Cultural Etiquette			
Working in a Cubicle			

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence L9-10RST 1-10 and L9-10WHST 1-10:

Georgia Standards of Excellence ELA/Literacy standards have been written specifically for technical subjects and have been adopted as part of the official standards for all CTAE courses.

Course Standard 2

MAN-RAS-2

Explain the history of automated systems and the benefits of those systems to manufacturing in a global society.

2.1 Define automated manufacturing/systems.

2.2 Describe the history of and early beginnings of automated manufacturing.

2.3 Compare safety procedures in today's automated manufacturing environment and compare those to safety procedures in early manufacturing, including: lock outs, tag outs, tool and machine safety, OSHA, safety zones, and the impact automation has had on safety. Include analysis that is research based on dollar costs of accidents from pre-automation to automated systems and with consideration to change in the value of a dollar over time.

2.4 State and discuss the components of an automated system.
2.5 State and discuss the advantages and disadvantages of automating a production system on a global economy.
2.6 Identify the practices, programs and systems utilized in automated manufacturing in terms of complexity, including the following: Basic Machine Controls, Materials Requirement planning (MRP II), Just-In-Time (JIT), Process Automation, Flexible Manufacturing Systems (FMS), Computer-Aided Design (CAD) and Computer- Aided Manufacturing (CAM), and Artificial Intelligence (AI).

Course Standard 3

MAN-RAS-3

Identify and explain the major engineering tasks in organizing automated manufacturing.

3.1 List the major engineering tasks in organizing a manufacturing operation, including selecting and sequencing operations, designing tooling, preparing plant layouts, and designing material handling.
3.2 Describe the purposes for operation sheets, flow process charts, and operation process charts.
3.3 Define the two major handling devices, Fixed Path and Variable Path, and discuss the best application of each.
3.4 Discuss the difference between process layouts and product layouts.
3.5 State that plant efficiency is determined by the effective use of resource flow in terms of moving people and materials through the factory efficiently.
3.6 State that process layout is used for factories that make a number of different products with each product being moved to different departments as needed for its manufacture.
3.7 Discuss the various continuous process lines and patterns including: Straight, S- shaped, circular, U-shaped and random.

Course Standard 4

MAN-RAS-4

Discuss the systems and applications of automation including: AGV, PLC, CNC, CIM, CAD, CAM, and robotics as essential to succeeding globally in a manufacturing market.

4.1 Define AGV, PLC, CNC, CIM, CAD, CAM, and Robotics.
4.2 Describe how AGV, PLC, CNC, CIM, CAD, CAM, and robotics can increasethe efficiency of a manufacturing facility.
4.3 Explain how industrial robots offer greater flexibility to automated production systems, specifically with reduction of labor costs and outsourcing oflabor.
4.4 Discuss the new approaches to automated manufacturing systems that support today's competitive environment, including: design for manufacture (DFM), design for assembly (DFA), and design for manufacture and assembly (DFMA).
4.5 Identify areas in which design analysis can be accomplished or implemented for product development.
4.6 Compare and contrast product quality between a product madethrough automation and a similar product produced through manual labor.

Course Standard 5

MAN-RAS-5

Outline the utilization of programmable control devices and data transfer.

5.1 Generate a device control flow chart or schematic for an automated manufacturing system.
5.2 State the advantages and disadvantages of utilizing various control devices, including those for pressure, heat, volume control, color, weight andtiming.
5.3 Discuss the various architecture in developing a controlled system, including buss, PLC, and LAN.

Course Standard 6

MAN-RAS-6

Apply the principles of PLC, CIM, CAD, CAM, and robotics in the manufacturing of a product.

6.1 Design an automated system using the principles of PLC, CIM, CAD, CAM, and/or robotics to manufacture a product on a continuous basis.
6.2 Analyze the products produced in their initial system and redesign the system for improved efficiency.
6.3 Generate a design portfolio to track development of this system from the beginning of the project.
6.4 Interact with an industry professional to develop this automated system.
6.5 Prepare process flow charts and product layout plans for the development of this system.
6.6 Research new emerging technologies that could improve this automated system utilized in a real-world environment.

Course Standard 7

MAN-RAS-7

Explore how related career and technology student organizations are integral parts of career and technology education courses. Students will develop leadership, interpersonal, and problem-solving skills through participation in co-curricular activities associated with the Technology Student Association.

7.1 Explain the goals, mission and objectives of CTSO organizations.
7.2 Explore the impact and opportunities a student organization (TSA) can develop to bring business and education together in a positive working relationship through innovative leadership and career development programs.
7.3 Explore the local, state, and national opportunities available to students through participation in related student organization (TSA) including but not limited to conferences, competitions, community service, philanthropy, and other (TSA) activities.
7.4 Explain how participation in career and technology education student organizations can promote lifelong responsibility for community service and professional development.
7.5 Demonstrate teamwork, leadership, interpersonal relations, and project management.
7.6 Through teamwork, apply the skills and abilities in requirements analysis and configuration control while working with plans, processes, and projects as assigned.
7.7 Through teamwork, use the skills required in project management to track and assess the progress of a plan, process, or project as assigned.
7.8 Through teamwork, apply the skills in quality assurance as well as those in process management and development for appropriate applications of systems integration techniques to an assigned project
7.9 Effectively use project management techniques (e.g., teamwork, appropriate time management practices, effective organizational skills, conduct analysis of cost, resources, and production capacity, and quality practices with continuous improvement).
7.10 Understand and demonstrate proper work ethics when working with plans, processes, and projects as assigned.