Advanced Manufacturing Technology

Strand 2: Technical Knowledge and Skills

2.A	Fundamentals of Safety in Machine Tool Technology	
	Hours of Instruction	80
2.A.01	Demonstrate machine tool safety	SKILL
2.A.01.01	Utilize personal protective equipment (PPE), following OSHA	LEVEL B, E
2.A.01.01	regulations and industry standards.	Б, Б
2.A.01.02	Explain and implement machine guarding.	В
2.11.01.02	Demonstrate safe operation of equipment, following OSHA regulations	В
	and industry standards.	D
	Performance Example:	/
	Students will demonstrate safe operation of equipment, following the	
	rules of the shop. Personal Protective Equipment (PPE) rules will be	
	strictly adhered to. Students will pass safety tests for all equipment	
	before they are allowed to operate said equipment.	
2.B	Problem Solving	
	Hours of Instruction	10
2.B.01	Demonstrate skills in problem solving	SKILL
0.7.04.04		LEVEL
2.B.01.01	Identify the problem or source of the problem.	B, E, A
2.B.01.02	Predict solutions using a structured problem-solving process.	B, E, A
2.B.01.03	Apply designated strategies to remedy the given problem.	B, E, A
	Performance Example: Using appropriate shop project designs, students will identify problems	
	in the manufacturing process. Students will solve these problems using	
	strategies in a group setting or alone.	
2.C	Machine Maintenance	
	Hours of Instruction	10
2.C.01	Manage equipment and machinery	SKILL
		LEVEL
2.C.01.01	Identify appropriate person(s) for maintenance and repair of	В
	equipment.	
2.C.01.02	Review and state equipment indicators to ensure that equipment is	Α
	operating according to manufacturer's specifications.	
2.C.01.03	Demonstrate ability to maintain equipment.	B, E, A
2.C.01.04	Report and maintain a written log for service and recommend process	E
	repair of equipment.	
	Performance Example: Students will follow a preventative maintenance program developed by	
	Students will follow a preventative maintenance program developed by the instructors according to machine specifications.	
2.D	Quality Control - Measuring/Inspection	
L.U	Hours of Instruction	50
	Equipment Needed – (Must Meet Industry Standards)	30
	24u.pmont recucu (riust ricct industry standards)	

	Coordinate Measuring Machines, Profilometer, Optical Comparator,	
	Height Gauge	
2.D.01	Review inspection procedures	SKILL LEVEL
2.D.01.01	Measure work piece with a scale within a tolerance of +/- 1/64".	В
2.D.01.02	Measure work piece outside diameter, inside diameter and depth with the precision instrument to a tolerance of +/001".	В
2.D.01.03	Measure work piece with a precision caliper within a tolerance of +/005".	В
2.D.01.04	Measure radius on a work piece.	B, E, A
2.D.01.05	Measure angle(s).	B, E, A
2.D.01.06	Measure location and size of a feature to a tolerance of at least +/001".	E, A
2.D.01.07	Identify a thread and measure outside and pitch diameter to design specifications.	E
2.D.01.08	Compare and/or measure surface finish quality of a part to print specification.	E, A
2.D.01.09	Describe clean room and climate-controlled environments and their	В
	purpose in the Manufacturing Industry.	
	Performance Example:	
	Students will demonstrate the ability to distinguish among the	
	appropriate precision measuring tools according to allowable	
	tolerances on a given design. Using appropriate measuring tools and a	
	print with specifications, the student will measure and document all dimensions to determine if a product passes inspection.	
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2.E	Material Sciences	10
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2.E.01	Material Sciences	SKILL
2.E.01	Material Sciences Hours of Instruction Describe material properties	SKILL LEVEL
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symbols, and fitment and weldment callouts that meet ANSI and ISO specifications. 2.6 Process Planning Hours of Instruction 2.6.01.01 Determine and select appropriate material, size and quantity needed to complete specified product(s). 2.6.01.02 Formulate an order of operations, proper tooling and workholding devices. 2.6.01.03 Describe LEAN principles Performance Example: Students will research all materials and tooling needed to build a product from the curriculum. Students will design a LEAN production plan that will satisfy the steps needed to create the project from start to completion. 2.H. Machining Operations Hours of Instruction 2.H. Drill a hole to the designated size and in the predetermined location. 2.H. Drill a hole to depth and diameter specified by blueprint and/or standard. 2.H. Drill a hole to a specified dopth and thread size. 2.H. Jap hole to specified depth and thread size. 2.H. Counter bore a hole to the specified diameter and depth according to the blueprint. 2.H. Calculate speeds and feeds for given tooling and material. Performance Example: Using shop developed projects and tasks, students will perform machining operations that are relevant to a multitude of machines. Power Saw Processes Hours of Instruction 2.L. Operate a Power Saw 3. KILL LEVEL 3. Cut material using power saws to specified length. Performance Example: Students will demonstrate the use of power saw equipment and cut material for the creation of shop designed projects and tasks. Because of Instruction 2.L. Operate a Power Saw 2.L. Operate a Power Saw 3. KILL LEVEL 3. Cut material using power saws to specified length. Performance Example: Students will demonstrate the use of power saw equipment and cut material for the creation of shop designed projects and tasks. Because of Instruction 2.L. Operate Power Saw Processes Hours of Instruction 3. Cut material using power saws to specified length. Performance Example: Students		interpretation of prints with geometric dimensioning and tolerancing	
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2.J.01.02 Deburr work piece.			LEVEL
•	•	•	B, E, A
Performance Example:	2.J.01.02	•	В
•		Performance Example:	

	Through classroom work and shop projects, students will demonstrate	
	the operations of finishing processes for the completion of a product.	
2.K	Grinding Processes	
2111	Hours of Instruction	10
	Equipment Needed - (Must Meet Industry Standards)	
	Surface Grinder, Bench Grinder	
2.K.01	Operate precision grinding equipment	SKILL LEVEL
2.K.01.01	Demonstrate mounting of a grinding wheel according to industry standards.	Α
2.K.01.02 2.K.02	Demonstrate precision grinding operations. Off-hand Grinding	A SKILL
2.11.02	On hand di munig	LEVEL
2.K.02.01	Dress wheel, set tool rest and spark guard on pedestal grinder to	В
2.K.02.02	proper height and clearance. Explain and demonstrate the grinding of tools for specific application	В
2.13.02.02	and use.	Б
	Performance Example:	
	Using industry standard equipment and classroom theory, students will	
	demonstrate precision grinding operations using the tools associated	
	with the production of square and cylindrical finished products.	
	Through classroom work and shop projects, students will demonstrate	
	the operations of offhand grinding for the completion of a product and	
2.1	sharpening of tools associated with the trade.	
2.L	Lathe Processes Hours of Instruction	150
	Equipment Needed – (Must Meet Industry Standards)	150
	Conversational and CNC Lathes	
2.L.01	Operate precision turning equipment	SKILL
2.2.01	operate precision tarning equipment	LEVEL
2.L.01.01	Identify and setup work-holding devices including universal and	B, E, A
2 1 24 22	independent chucks and collets.	D T 4
2.L.01.02	Demonstrate outside turning procedures, including facing, grooving,	B, E, A
2.L.01.03	turning diameters to a shoulder, and tapering to a specified tolerance.	E, A
2.L.01.03	Demonstrate inside turning procedures, including boring, grooving and tapering to a specified tolerance.	E, A
2.L.01.04	Demonstrate single-point threading to a specified tolerance.	E, A
2.L.01.05	Demonstrate cut-off techniques.	E, A
2.L.01.06	Machine a form into the work piece.	Α
2.L.01.07	Knurl a piece to design specifications from blue print.	В
2.L.01.08		DEA
2.11.01.00	File and polish a work piece.	B, E, A
2.2.01.00	Performance Example:	D, E, A
2.2.01.00	Performance Example: Students will demonstrate skills in the turning of cylindrical and square	D, E, A
2.2.01.00	Performance Example: Students will demonstrate skills in the turning of cylindrical and square stock through the completion of shop designed projects and tasks.	D, E, A
2.2.01.00	Performance Example: Students will demonstrate skills in the turning of cylindrical and square stock through the completion of shop designed projects and tasks. Through the selection of appropriate work holding devices, students	D, E, A
2.2.01.00	Performance Example: Students will demonstrate skills in the turning of cylindrical and square stock through the completion of shop designed projects and tasks. Through the selection of appropriate work holding devices, students will demonstrate a working knowledge set up and fixtures needed for	D, E, A
	Performance Example: Students will demonstrate skills in the turning of cylindrical and square stock through the completion of shop designed projects and tasks. Through the selection of appropriate work holding devices, students will demonstrate a working knowledge set up and fixtures needed for the completion of machining processes.	D, E, A
2.M	Performance Example: Students will demonstrate skills in the turning of cylindrical and square stock through the completion of shop designed projects and tasks. Through the selection of appropriate work holding devices, students will demonstrate a working knowledge set up and fixtures needed for the completion of machining processes. Milling Processes	
	Performance Example: Students will demonstrate skills in the turning of cylindrical and square stock through the completion of shop designed projects and tasks. Through the selection of appropriate work holding devices, students will demonstrate a working knowledge set up and fixtures needed for the completion of machining processes.	150

	Conversational and CNC Mills	
2.M.01	Operate precision milling equipment	SKILL
		LEVEL
2.M.01.01	Indicate vise within a tolerance of .0005" over a 6" span.	B, E
2.M.01.02	Tram milling head within a tolerance of .001" over a 6" diameter sweep.	E, A
2.M.01.03	Locate a datum feature using an edge finder.	B, E
2.M.01.04	Locate and indicate holes and pins.	E, A
2.M.01.05	Mill a flat surface within a specified surface finish using a variety of tooling.	B, E
2.M.01.06	Mill a variety of angles within a specified tolerance.	E, A
2.M.01.07	Square a work piece within a specified tolerance.	E
2.M.01.08	Apply climb and conventional milling strategies.	В
2.M.01.09	Mill a shoulder, slots and pockets within a specified tolerance.	В
2.M.01.10	Setup and Bore a hole to size and location within a tolerance of +/001".	Α
2.M.01.11	Describe the operation of keys and keyways.	В
2.M.01.12	Mill keyways and keyseats to specifications.	A
	Performance Example:	
	Students will demonstrate skills in the set up and milling of shapes and	
	surfaces using cylindrical and square material through the completion of shop designed projects and tasks. Using industry standard locating	
	tools, students will demonstrate a working knowledge of datums to	
	setup and machine a finish product.	
2.N	Computer Aided Drafting and Design (CAD)	
2.14	Hours of Instruction	200
	Equipment Needed - (Must Meet Industry Standards)	200
	Computers, CAD Software	
2.N.01	Demonstrate and apply basic CAD operations using current	SKILL
	industry standard software	LEVEL
2.N.01.01	Create solid three-dimensional models.	В, Е, А
2.N.01.02	Create three-dimensional assembly models.	Á
2.N.01.03	Create part level design or drawing specifications.	B, E, A
2.N.01.04	Create assembly level design and drawing specifications.	Α
2.N.01.05	Convert files to generic formats i.e. (.pdf, .dxf, .igs, .stp, .stl, etc.).	В
	Performance Example:	
	Modify or create model based on requirements, record CAD data and	
	create output file.	
2.0	Additive Manufacturing Process	
	Hours of Instruction	20
	Equipment Needed	
0.04	Additive Manufacturing Equipment	CIZILI
2.0.01	Use additive manufacturing	SKILL
2 0 01 01	Domonatusta manufacturing a next using an additive manufacturing	LEVEL
2.0.01.01	Demonstrate manufacturing a part using an additive manufacturing machine.	Α
	Performance Example:	
	Students will produce an additive manufacturing part based on CAD	
	model they have created.	
2.P	CNC Programming	
	0.1011061000000	

	Hours of Instruction	90
	Equipment Needed - (Must Meet Industry Standards)	70
	Conversational and CNC Mills/Lathes, and Respective Simulators	
2.P.01	Demonstrate basic programming strategies at the machine control	SKILL
	1 0 0 0	LEVEL
2.P.01.01	Define G and M codes.	B, E, A
2.P.01.02	Construct a safe and effective part program using G and M codes.	B, E, A
2.P.01.03	Construct a safe and effective part program using conversational	B, E, A
	programming strategies.	• •
2.P.01.04	Transfer part program to and from a machine control.	B, E, A
	Performance Example:	, ,
	Using industry standard CNC equipment and classroom theory,	
	students will demonstrate a working knowledge of a written program	
	and the different codes that are associated within it.	
2.Q	Computer Aided Manufacturing (CAM)	
·	Hours of Instruction	200
	Equipment Needed - (Must Meet Industry Standards)	
	CAM Software, Computers, CNC Machines	
2.Q.01	Demonstrate and apply the Computer Aided Manufacturing (CAM)	SKILL
	process using industry standard software	LEVEL
2.Q.01.01	Use computer aided manufacturing (CAM) software to apply machining	B, E, A
2.0.01.01	processes to design (e.g., speeds, feeds, cutter compensation, etc.).	В, Ц, 11
2.Q.01.02	Post process program and transfer to and from CNC machine.	В, Е, А
2101102	Performance Example:	2, 2, 11
	Using industry standard software, students will design and apply	
	machining processes for the completion of shop projects and tasks.	
	Students will demonstrate the process of posting and receiving of	
	programs to a CNC machine to properly complete a project to shop	
	specifications.	
2.R	CNC Machine Set up and Operations	
2.IX	Hours of Instruction	200
	Equipment Needed - (Must Meet Industry Standards)	200
	CNC Mills and CNC Lathes	
2.R.01	Operate CNC and conversational machines	SKILL
	opolaro di cama con constitui anticono	LEVEL
2.R.01.01	Use Manual Data Input (MDI) and control panel operations including	B, E, A
	simple programming, tool changes and spindle speeds.	_,_,
2.R.01.02	Demonstrate sequential start-up and shut-down operations.	В
2.R.01.03	Set up datum point, tool length offsets and tool geometry offsets.	B, E, A
2.R.01.04	Set cutter compensation.	B, E, A
2.R.01.05	Load programs, dry run, edit, and execute program.	B, E, A
2111101100	Performance Example:	2, 2,11
	Students will demonstrate the operation of the control panel to set up,	
	run, and edit a program for a shop designed project.	
2.S	Advanced CNC Set up and Operations*	
	Hours of Instruction	40
	Equipment Needed - (Must Meet Industry Standards)	_ 3
	4 and 5 Axis Mills, Live Tooling Lathes, Probing Systems	
2.S.01	Advanced Multiple Axis and Live Tooling	SKILL
		LEVEL
		_

2.S.01.01	Set up a workpiece on a CNC milling 4th axis rotary table.	A+
2.S.01.02	Set up a workpiece on a 5-axis CNC milling machine.	A+
2.S.01.03	Set up live tooling on a CNC mill/turn center.	A+
2.S.01.04	Set part origin on a CNC milling machine using a probing system.	A+
2.S.01.05	Set tool length and diameter offsets on a CNC milling machine using a	A+
	table mounted tool setter.	
2.S.01.06	Set multi-axis offsets with a CNC lathe tool presetter.	A+
2.5.01.00	Performance Example:	
	Students will demonstrate the operation of the control panel to set up,	
	run, and edit a program for a shop designed project using 4 axis, 5 axis	
	milling as well as live tooling.	
2.T	Electrical Discharge Machining (EDM) (A+)	
	Hours of Instruction	40
2.T.01	Use Electrical Discharge Machining Equipment (A+)	SKILL
	oso zicoti ioni z isonui go riuominii g zquipinoni (ii v)	LEVEL
2.T.01.01	Demonstrate manufacturing a part using an electrical discharge	A+
2.1.01.01	machine.	11.
	Performance Example:	
	Students will produce a part utilizing EDM technology.	
2.U	Robotics (A+)	
	Hours of Instruction	40
2 11 04		
Z.U.U I	Describe how robotics are used in the manufacturing process	SKILL
2.U.01	Describe how robotics are used in the manufacturing process	SKILL LEVEL
		LEVEL
2.U.01.01	Describe a Computer Integrated Manufacturing (CIM) system utilizing	
2.U.01.01	Describe a Computer Integrated Manufacturing (CIM) system utilizing appropriate safety precautions. (i.e cages, light curtains).	LEVEL A+
	Describe a Computer Integrated Manufacturing (CIM) system utilizing appropriate safety precautions. (i.e cages, light curtains). Describe automated systems engineering introductory knowledge and	LEVEL
2.U.01.01 2.U.01.02	Describe a Computer Integrated Manufacturing (CIM) system utilizing appropriate safety precautions. (i.e cages, light curtains). Describe automated systems engineering introductory knowledge and skills.	LEVEL A+ A+
2.U.01.01 2.U.01.02 2.U.01.03	Describe a Computer Integrated Manufacturing (CIM) system utilizing appropriate safety precautions. (i.e cages, light curtains). Describe automated systems engineering introductory knowledge and skills. Define an automated system and a robot.	LEVEL A+ A+ A+
2.U.01.01 2.U.01.02 2.U.01.03 2.U.01.04	Describe a Computer Integrated Manufacturing (CIM) system utilizing appropriate safety precautions. (i.e cages, light curtains). Describe automated systems engineering introductory knowledge and skills. Define an automated system and a robot. Identify individual components used in CIM systems.	A+ A+ A+ A+
2.U.01.01 2.U.01.02 2.U.01.03	Describe a Computer Integrated Manufacturing (CIM) system utilizing appropriate safety precautions. (i.e cages, light curtains). Describe automated systems engineering introductory knowledge and skills. Define an automated system and a robot. Identify individual components used in CIM systems. Describe the working relationship between the CNC equipment and the	LEVEL A+ A+ A+
2.U.01.01 2.U.01.02 2.U.01.03 2.U.01.04 2.U.01.05	Describe a Computer Integrated Manufacturing (CIM) system utilizing appropriate safety precautions. (i.e cages, light curtains). Describe automated systems engineering introductory knowledge and skills. Define an automated system and a robot. Identify individual components used in CIM systems. Describe the working relationship between the CNC equipment and the robot.	A+ A+ A+ A+ A+ A+
2.U.01.01 2.U.01.02 2.U.01.03 2.U.01.04	Describe a Computer Integrated Manufacturing (CIM) system utilizing appropriate safety precautions. (i.e cages, light curtains). Describe automated systems engineering introductory knowledge and skills. Define an automated system and a robot. Identify individual components used in CIM systems. Describe the working relationship between the CNC equipment and the robot. Describe and identify various grippers: standard, servo, non-servo,	A+ A+ A+ A+
2.U.01.01 2.U.01.02 2.U.01.03 2.U.01.04 2.U.01.05 2.U.01.06	Describe a Computer Integrated Manufacturing (CIM) system utilizing appropriate safety precautions. (i.e cages, light curtains). Describe automated systems engineering introductory knowledge and skills. Define an automated system and a robot. Identify individual components used in CIM systems. Describe the working relationship between the CNC equipment and the robot. Describe and identify various grippers: standard, servo, non-servo, vacuum, and magnetic (end effector).	A+ A+ A+ A+ A+ A+
2.U.01.01 2.U.01.02 2.U.01.03 2.U.01.04 2.U.01.05	Describe a Computer Integrated Manufacturing (CIM) system utilizing appropriate safety precautions. (i.e cages, light curtains). Describe automated systems engineering introductory knowledge and skills. Define an automated system and a robot. Identify individual components used in CIM systems. Describe the working relationship between the CNC equipment and the robot. Describe and identify various grippers: standard, servo, non-servo, vacuum, and magnetic (end effector). Define the following robot terms: degrees of freedom, position axes,	A+ A+ A+ A+ A+ A+
2.U.01.01 2.U.01.02 2.U.01.03 2.U.01.04 2.U.01.05 2.U.01.06 2.U.01.07	Describe a Computer Integrated Manufacturing (CIM) system utilizing appropriate safety precautions. (i.e cages, light curtains). Describe automated systems engineering introductory knowledge and skills. Define an automated system and a robot. Identify individual components used in CIM systems. Describe the working relationship between the CNC equipment and the robot. Describe and identify various grippers: standard, servo, non-servo, vacuum, and magnetic (end effector). Define the following robot terms: degrees of freedom, position axes, orientation axes, work envelope, tool center point.	A+ A+ A+ A+ A+ A+
2.U.01.01 2.U.01.02 2.U.01.03 2.U.01.04 2.U.01.05 2.U.01.06	Describe a Computer Integrated Manufacturing (CIM) system utilizing appropriate safety precautions. (i.e cages, light curtains). Describe automated systems engineering introductory knowledge and skills. Define an automated system and a robot. Identify individual components used in CIM systems. Describe the working relationship between the CNC equipment and the robot. Describe and identify various grippers: standard, servo, non-servo, vacuum, and magnetic (end effector). Define the following robot terms: degrees of freedom, position axes, orientation axes, work envelope, tool center point. Define and give an example of the following specifications for industrial	A+ A+ A+ A+ A+ A+
2.U.01.01 2.U.01.02 2.U.01.03 2.U.01.04 2.U.01.05 2.U.01.06 2.U.01.07	Describe a Computer Integrated Manufacturing (CIM) system utilizing appropriate safety precautions. (i.e cages, light curtains). Describe automated systems engineering introductory knowledge and skills. Define an automated system and a robot. Identify individual components used in CIM systems. Describe the working relationship between the CNC equipment and the robot. Describe and identify various grippers: standard, servo, non-servo, vacuum, and magnetic (end effector). Define the following robot terms: degrees of freedom, position axes, orientation axes, work envelope, tool center point. Define and give an example of the following specifications for industrial robots: payload, repeatability, memory capacity, and environmental	A+ A+ A+ A+ A+ A+
2.U.01.01 2.U.01.02 2.U.01.03 2.U.01.04 2.U.01.05 2.U.01.06 2.U.01.07 2.U.01.08	Describe a Computer Integrated Manufacturing (CIM) system utilizing appropriate safety precautions. (i.e cages, light curtains). Describe automated systems engineering introductory knowledge and skills. Define an automated system and a robot. Identify individual components used in CIM systems. Describe the working relationship between the CNC equipment and the robot. Describe and identify various grippers: standard, servo, non-servo, vacuum, and magnetic (end effector). Define the following robot terms: degrees of freedom, position axes, orientation axes, work envelope, tool center point. Define and give an example of the following specifications for industrial robots: payload, repeatability, memory capacity, and environmental requirements.	A+ A+ A+ A+ A+ A+ A+ A+
2.U.01.01 2.U.01.02 2.U.01.03 2.U.01.04 2.U.01.05 2.U.01.06 2.U.01.07	Describe a Computer Integrated Manufacturing (CIM) system utilizing appropriate safety precautions. (i.e cages, light curtains). Describe automated systems engineering introductory knowledge and skills. Define an automated system and a robot. Identify individual components used in CIM systems. Describe the working relationship between the CNC equipment and the robot. Describe and identify various grippers: standard, servo, non-servo, vacuum, and magnetic (end effector). Define the following robot terms: degrees of freedom, position axes, orientation axes, work envelope, tool center point. Define and give an example of the following specifications for industrial robots: payload, repeatability, memory capacity, and environmental requirements. Describe open-loop and close-loop control systems.	A+ A+ A+ A+ A+ A+
2.U.01.01 2.U.01.02 2.U.01.03 2.U.01.04 2.U.01.05 2.U.01.06 2.U.01.07 2.U.01.08	Describe a Computer Integrated Manufacturing (CIM) system utilizing appropriate safety precautions. (i.e cages, light curtains). Describe automated systems engineering introductory knowledge and skills. Define an automated system and a robot. Identify individual components used in CIM systems. Describe the working relationship between the CNC equipment and the robot. Describe and identify various grippers: standard, servo, non-servo, vacuum, and magnetic (end effector). Define the following robot terms: degrees of freedom, position axes, orientation axes, work envelope, tool center point. Define and give an example of the following specifications for industrial robots: payload, repeatability, memory capacity, and environmental requirements. Describe open-loop and close-loop control systems. Performance Example:	A+ A+ A+ A+ A+ A+ A+ A+
2.U.01.01 2.U.01.02 2.U.01.03 2.U.01.04 2.U.01.05 2.U.01.06 2.U.01.07 2.U.01.08	Describe a Computer Integrated Manufacturing (CIM) system utilizing appropriate safety precautions. (i.e cages, light curtains). Describe automated systems engineering introductory knowledge and skills. Define an automated system and a robot. Identify individual components used in CIM systems. Describe the working relationship between the CNC equipment and the robot. Describe and identify various grippers: standard, servo, non-servo, vacuum, and magnetic (end effector). Define the following robot terms: degrees of freedom, position axes, orientation axes, work envelope, tool center point. Define and give an example of the following specifications for industrial robots: payload, repeatability, memory capacity, and environmental requirements. Describe open-loop and close-loop control systems. Performance Example: Student will describe the integration of robotics into the manufacturing	A+ A+ A+ A+ A+ A+ A+ A+
2.U.01.01 2.U.01.02 2.U.01.03 2.U.01.04 2.U.01.05 2.U.01.06 2.U.01.07 2.U.01.08	Describe a Computer Integrated Manufacturing (CIM) system utilizing appropriate safety precautions. (i.e cages, light curtains). Describe automated systems engineering introductory knowledge and skills. Define an automated system and a robot. Identify individual components used in CIM systems. Describe the working relationship between the CNC equipment and the robot. Describe and identify various grippers: standard, servo, non-servo, vacuum, and magnetic (end effector). Define the following robot terms: degrees of freedom, position axes, orientation axes, work envelope, tool center point. Define and give an example of the following specifications for industrial robots: payload, repeatability, memory capacity, and environmental requirements. Describe open-loop and close-loop control systems. Performance Example:	A+ A+ A+ A+ A+ A+ A+ A+

